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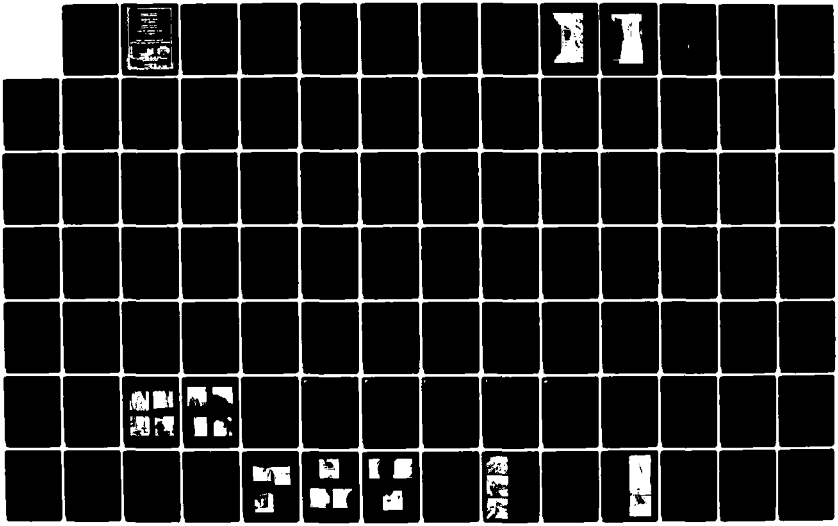

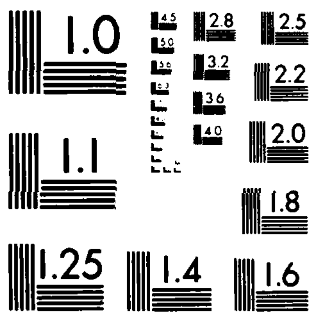

MICROCOPY RESOLUTION TEST CHART
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Farmington River Basin
New Hartford, Connecticut
Burlington, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Nepaug Dam is a semi-arch gravity type dam with a spillway. It is 600 feet long and 113 feet high. The Phelps Brook Dam is an earth dam with a concrete core wall. It is 1,250 feet and 67 feet respectively. Both of these dams are located at opposite ends of the Nepaug Reservoir. The project will pass the Probable Maximum Flood without overtopping the dam. The general condition of both dams and apputenant structures is good.

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NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

	Nepaug Dam	Phelps Brook
Identification Number:	CT 00370	CT 00378
Name:	Nepaug Dam	Phelps Brook Dam
Town:	New Hartford	Burlington
County and State:	Litchfield	Hartford,
	Connecticut	
Streams:	Nepaug River and Phelps Brook tributaries to the Farmington River	
Dates of Inspection:	June 6 and 8, 1978	

BRIEF ASSESSMENT

The Nepaug Dam is a semi-arch gravity type dam with a spillway. It is 600 feet long and 113 feet high. The Phelps Brook Dam is an earth dam with a concrete core wall. It is 1,250 feet and 67 feet respectively. Both of these dams are located at opposite ends of the Nepaug Reservoir. The Phelps Brook Dam has no overflow.

The project will pass the Probable Maximum Flood (recommended Spillway Design Flood) without overtopping the dam. The general condition of both dams and appurtenant structures is good.

Some recommended measures to be undertaken by the owner include monitoring movements of parapet walls at the upper gate house of the Phelps Brook Dam, monitoring seepage at both dams and vibrations at the Nepaug Dam during periods of heavy flow. It is not urgent to implement these recommendations. However, it is recommended that the owner implement them within two to three years after receipt of this Phase I Inspection Report.

Joseph F. Merluzzo
Connecticut P.E. #7639
Project Manager

Richard F. Lyon
Connecticut P.E. #8443
Project Engineer

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PREFACE

This report is prepared under quidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface evaluations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify the need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and varity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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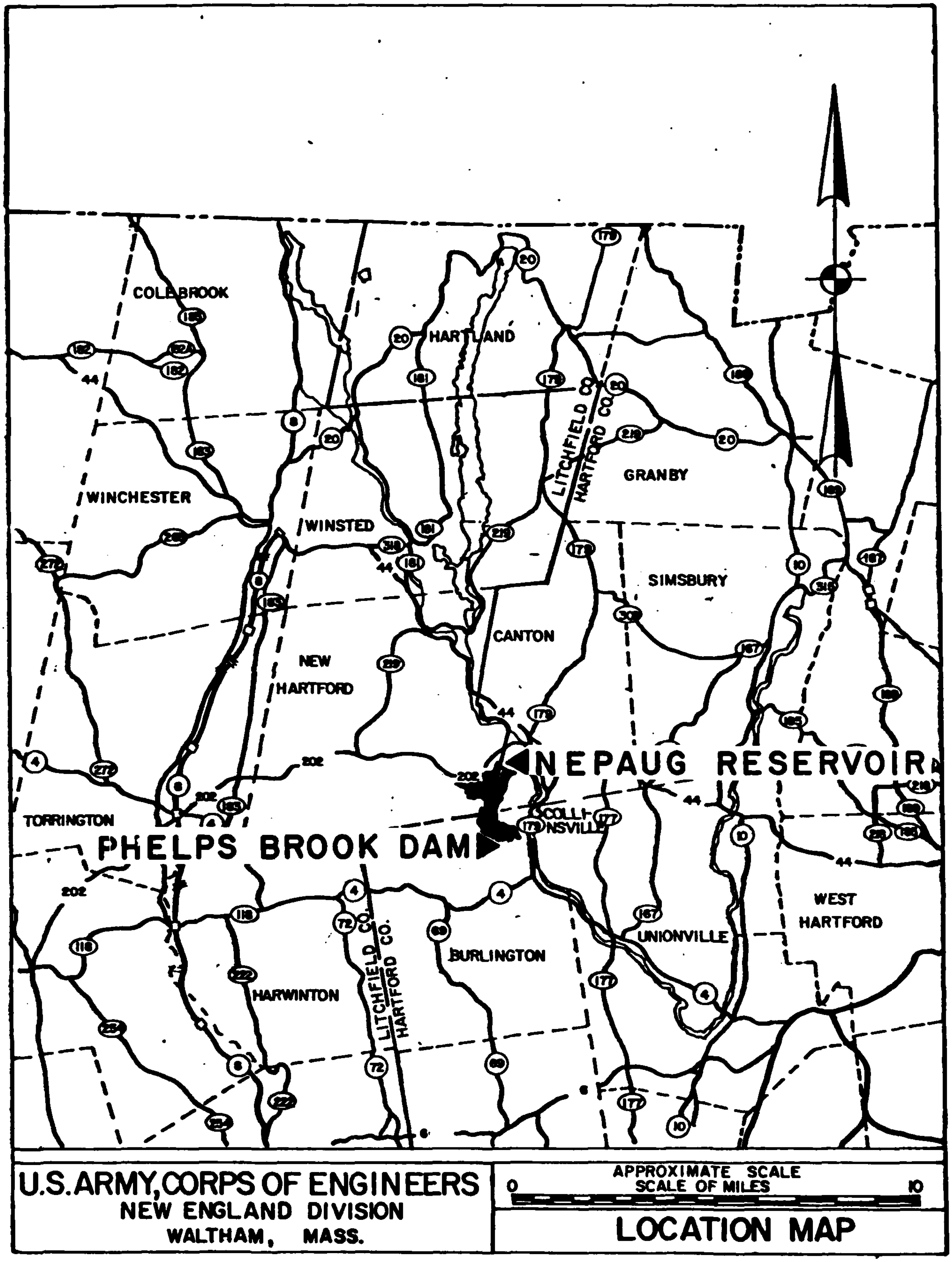
OVERVIEW PHOTO - PHELPS BROOK DAM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HARTLAND
WINCHESTER
WINSTED
GRANBY
LITCHFIELD CO.
HARTFORD CO.
SIMSBURY
CANTON
NEW HARTFORD
NEPAUG RESERVOIR
TORRINGTON
PHELPS BROOK DAM
COLLINSVILLE
WEST HARTFORD
UNIONVILLE
BURLINGTON
HARWINTON
U.S.ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASS.
APPROXIMATE SCALE
SCALE OF MILES
0
10
LOCATION MAP

PHASE I INSPECTION REPORT

NEPAUG DAM CT 00370

and

PHELPS BROOK DAM CT 00378

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Storch Engineers has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Storch Engineers under a letter of May 8, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0000 has been assigned by the Corps of Engineers for this work.

b. Purpose -

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly, effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

The Nepaug and Phelps Brook Dams are two of the eighteen dams that are owned by the Metropolitan District of Hartford County, Connecticut. These two dams are located at opposite ends of the Nepaug Reservoir which serves as water supply to the greater Hartford Area as well as the City of New Britain. The east dike of this reservoir was not inspected as part of the scope of work.

The Nepaug Dam is located in the Town of New Hartford, Connecticut and is a semi-arch gravity type dam with a spillway. It was designed by the staff of the Metropolitan District with the assistance of several expert consultants. It was constructed between 1914 and 1918 with Fred T. Ley of Springfield, Massachusetts serving as the general contractor.

The Phelps Brook Dam is located in the Town of Burlington, Connecticut and is an earth dam with a concrete core wall. The spillway for this reservoir is the Nepaug Dam, therefore, this embankment has no overflow. It was also designed by the Metropolitan District in conjunction with several expert consultants. It was constructed between 1915 and 1917 with Pierson Engineering & Construction Company of Bristol, Connecticut as the general contractor.

For both dams, the size classification is large (Nepaug is 113 feet high and Phelps Brook is 67 feet high and both impound approximately 40,000 acre feet) and the hazard classification is high per criteria set forth in the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers. The immediate downstream area which will be affected by the dams failure as shown on Plates 6, 7 and 8, (Appendix D), includes sections of Collinsville and Unionville as well as numerous homes and farms in between those communities.

There is a regular staff of maintenance personnel available. The items that are scheduled for regular maintenance include the cutting of grass on the embankment of the dam and servicing of the upper and lower gate house equipment.

The person in charge of day to day operation of the dam is Irv Hart, MDC Supply Division Headquarters, Beach Rock Road, Barkhamsted, Connecticut; Telephone Number: 379-0938.

The normal operating procedure for these dams is by manual means and only for water supply. The adequacy of the spillway and the need for the operation of the Nepaug Dam is dicussed in Section 5.

1.3 Pertinent Data

a. Drainage Area - The 31.9 square mile drainage area that contributes to the Nepaug Reservoir is a sluggish one as far as response to rainfall is concerned. The terrain is hilly with some development.

b. Discharge at Damsite - Maximum known flood discharge at the spillway (Nepaug Dam) is 8,280 cfs and the pond elevation was 491.85 (August, 1955).

(1) Outlet works (conduits) 48 inch and 42 inch at invert elevations 420.0 and 430.0, respectively.

(2) Maximum known flood at damsite 8,280 cfs.

(3) Ungated spillway capacity at maximum pool elevation: 23,000 cfs at 494.5 elevation.

(4) Gated spillway capacity at pool elevation N/A cfs at N/A elevation.

(5) Gated spillway at maximum pool elevation N/A cfs at N/A elevation.

(6) Total spillway capacity at maximum pool elevation: 23,000 cfs at 494.5 elevation.

c. Elevation (Feet above MSL)

		Nepaug	Phelps
(1)	Top Dam:	495.5	494.5
(2)	Maximum pool-design surcharge (MDC):	487.5	487.5
(3)	Full flood-control pool:	N/A	
(4)	Recreation pool:	N/A	
(5)	Spillway crest:	492.5	--
(6)	Upstream portal invert diversion tunnel:	420.0	430.0

	Nepaug	Phelps-
(7) Streambed at centerline of dam:	383.5	424.5
(8) Maximum tailwater:	392.5	--

d. Reservoir

(1) Length of maximum pool: 11,600 feet ±

(2) Length of recreation pool: N/A

(3) Length of flood-control pool: N/A

e. Storage (Acre-Feet)

(1) Recreation pool: N/A

(2) Flood-control pool: N/A

(3) Design surcharge (MDC): 34,120 ±

(4) Top of dam: 40,540 ±

f. Reservoir Surface (Acres)

(1) Top of dam: 965 ±

(2) Maximum pool: 900 ±

(3) Flood-control pool: N/A

(4) Recreartion pool: N/A

(5) Spillway crest: 850 ±

ga. Dam - Nepaug

(1) Type: Concrete gravity arch

(2) Length: 600 feet ±

(3) Height: 113 feet ±

(4) Top Width: 22 feet ±

(5) Side Slopes: upstream - vertical to 1:0.06

downstream - 1:0.56 to 1:0.75

(6) Zoning: N/A

(7) Impervious Core: N/A

(8) Cutoff: Not less than 15 feet

(9) Grout curtain: 10 to 15 feet

(10) Other: N/A

gb. Dam - Phelps Brook

(1) Type: Earth embankment with concrete core wall

(2) Length: 1,250 feet ±

(3) Height: 67 feet ±

(4) Top width: 15 feet ±

(5) Side Slopes: Varies; upstream - 1:3 to 1:2
downstream - 1:2.5 to 1:1.75

(6) Zoning: See cross section, Appendix B,
Plate 3

(7) Impervious core: Concrete

(9) Cutoff: Not less than 10 feet ±

(9) Grout Curtain: 15 to 25 feet ±

(10) Other: N/A

h. Diversion and Regulating Tunnel (Phelps)

(1) Type: Concrete

(2) Length: 190 feet ±

(3) Closure: Not applicable

(4) Access: Lower gate house

(5) Regulating: Manually operated gate

i. Spillway (Nepaug)

(1) Type: Concrete fixed weir

(2) Length of Weir: Five bays at 35 feet = 175 feet

(3) Crest elevation: 482.5

(4) Gates: None

(5) U/S channel: none

(6) D/S channel: rock lined channel

(7) General: N/A

j. Regulating Outlets

Regulating outlets consist of a 48 inch cast iron pipe with a 24 inch blowoff at Nepaug Dam and a 42 inch cast iron pipe with a 30 inch blowoff at Phelps Brook Dam. The primary use for both of these outlets is for water supply. The blowoffs are rarely used.

	Nepaug	Phelps
(1) Invert:	420.0	430.0
(2) Size:	48 inch	42 inch

(3) Description: Cast iron water mains

(4) Control Mechanism: Hand operated gates

(5) Other: N/A

SECTION 2 - ENGINEERING DATA

2.1 Design

An account of the specific design considerations for the design of both dams is covered in Section 6. However, there were several prominent consultants, such as, Herbert E. Gregory, Geology consultant; John R. Freeman, Core wall consultant and Frederic P. Stearns, consultant for design of the embankment configuration and details of Nepaug Dam. All of the references are contained in Appendix B, Reference 3.

2.2 Construction

The Nepaug Dam was constructed between 1914 and 1918 by Fred T. Ley, Springfield, Massachusetts and the Phelps Brook Dam was constructed between 1915 and 1917 by Pierson Engineering and Construction Company, Bristol, Connecticut.

The only helpful information that remains about the history of the original construction is in the form of the pictorial record that is kept at the Metropolitan District Engineering Department. From the information that is available, there were no unusual problems that occurred during the construction period. The spillway restoration project on the Nepaug Dam was completed between 1974 and 1976 and is well documented with inspection reports, borings, contract plans and specifications (Appendix B, References 4 - 11).

2.3 Operation

The main function of the M.D.C. staff is for maintaining the water supply equipment that is appurtenant to each dam. There is no operation required for the spillway at the Nepaug Dam or the service tunnel at the Phelps Brook Dam, however, the staff checks the functioning of each one to insure that no blockage or other problem goes unnoticed.

2.4 Evaluation

a. Availability - Design, construction and operation information was readily available. The one area which was lacking in terms of design information was for embankment slope stability. However, the state of the art for embankment design, at that time, was such that no detail design was performed. A list of references is contained in Appendix B of this report.

b. Adequacy - The information made available for this inspection along with the visual inspection, past performance history and hydrologic and hydraulic assumptions were more than adequate to assess the condition of the dam.

c. Validity - The validity of the information made available is not questionable and the history of the dam seems to bear this out.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General - The inspection of the Nepaug Dam and the Phelps Brook Dam took place on June 6, 1978 and June 8, 1978, respectively by members of the engineering staff of Storch Engineers with the help of Peter Revill of the Metropolitan District. A copy of the visual inspection check list is contained in Appendix A of this report.

The following procedures were used for the inspection:

1. The top and side slopes of the dams, appurtenant structures and their parts were examined.
2. The banks in the downstream areas were visually surveyed.
3. The upstream surfaces of both dams, outside gate houses and weir, as well as the banks of the reservoir were inspected by boat.
4. The dam crest at the Phelps Brook Dam was level surveyed by instrument.
5. Areas were checked for seepage discharge.
6. The temperatures of seepage water, water in the reservoir and water downstream were measured.

7. Areas that showed evidence of leaking, leaching or some damage were sketched or noted.

8. The dams and their appurtenant structures were photographed (Appendix C).

Before the inspection commenced, the design, construction, operation and maintenance documentation, results of repair and prior inspections were compiled and studied. A compact sketch of the main structures was used for orientation during the period of inspection (Appendix B, Plate 1). In general, the overall appearance and condition of the dams and their appurtenant structures is good.

b. Dam - The inspection gallery of the Nepaug Dam has several areas of seepage and efflorescence at drain holes, expansion joints, hairline cracks in the walls and through drainage tiles that penetrate the walls near the top of the gallery. A measurement of the seepage that found its way into the inspection gallery was in the order of 1 to 2 gallons/minute. The photos in Appendix C show clearly these typical conditions.

The Nepaug Dam spillway concrete was a problem from the beginning. Each time "gunite" was applied to the spillway, the length of time before it would spall or deteriorate again would vary between two and ten years. After several attempts to repair the deteriorated concrete of the spillway with gunite, money was finally appropriated to recap the

deteriorated sections with concrete. In 1976, work was completed for this restoration.

Also included in the concrete repair was the bridge that spanned the spillway weir. During construction, the bridge was virtually rebuilt and the remainder of the roadway surface on the dam was covered with an epoxy grout. The downstream face of the dam, outside of the spillway buttresses, was not repaired with new concrete because there were not enough funds available and priority was given to the "working" surface of the dam.

An inspection of the upstream face of Nepaug Dam by boat pointed out some areas near the waterline that have evidences of cavitation or damage to the concrete (Appendix C, Photos 7 and 8, Page II-4A).

The downstream face of the Phelps Brook Dam does not have any visible cracks, bulges or horizontal or vertical movements. The drainage tiles that comes from the body of the dam has a steady flow with deposits of red clay on the bottom. Measurement of this flow was taken (Appendix C, Photos 7 and 8, Page II-B) and found to be approximately four gallons per minute. There were no visible soft or wet spots noted at any point along the toe of the dam.

The upstream embankment was in excellent condition. The hand-placed riprap seems to have held a straight alignment.

According to officials of the Metropolitan District, there have been no repairs to this embankment since it was built.

c. Appurtenant Structures - At the Nepaug Dam, the upper gate house was included in the repair work completed in 1974 and the condition of the concrete is considered to be very good. The roof was replaced and this structure appears to be "weather-tight". The concrete of the gate house chamber appears sound but could not be viewed entirely because it is underwater. The lower gate house is undergoing some work and is in need of repair (i.e. spalling concrete and damaged floor).

The crane rail system in the upper gate house of the Phelps Brook Dam has just been replaced. This system has made it easier to replace the screens which are used to filter the water. The condition of the interior of this building is good, however, there are some evidences of spalling and damage to the exterior (Appendix C, Photo 2, Page II-1B).

In the lower gate house the concrete is old but in very sound condition. The construction joints in the service tunnel of the Phelps Brook Dam (Appendix C, Photos 5 and 6, Page II-3B) show evidences of some leaking.

d. Reservoir Area - The reservoir area near the dams appeared to be in a very natural state with no evidences of erosion or scour.

e. Downstream Channel - At the Nepaug Dam there is evidence of several loose stones and overhanging trees just downstream of the spillway apron. The Metropolitan District has made some repairs to this area immediately after some major storms. The original wingwall design has been modified and reinforced with consideration being given to the damage experienced during these storms.

At the Phelps Brook Dam there are evidences of silt deposits from the underdrain system downstream as far as 200 feet.

3.2 Evaluation

The visual inspection of these facilities did not reveal any apparent areas of major distress. The general condition of the dams is good.

The important features that were looked for in the visual inspection of the Phelps Brook Dam were surface cracks in the face of the dam, excessive leaking or seepage in the toe of the dam, distress or misalignment of the construction joints in the service tunnel and piping or erosion in the area of the service tunnel. Similarly at the Nepaug Dam, the important items of the inspection were

excessive flows into the inspection gallery through cracks, drains or joints in the body of the dam, leaking around the sides of the dam and piping or boils at the base of the structure.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The maintenance personnel for this facility are headquartered near the south end of the Nepaug Reservoir and take care of the ordinary maintenance of the dams as well as the water supply equipment. Each end of the reservoir is patrolled at least once a day to check for any functional or maintenance problem that may have occurred. During a heavy storm, the monitoring is more frequent. There is no written procedure for this inspection.

4.2 Maintenance of Dam

The main part of the routine maintenance of the dams is the mowing of the grass on the embankment or in the adjacent areas. Repairs or any substantial work which are to be done to the body of the Nepaug Dam have to be approved and funded separately from routine maintenance by the Metropolitan District.

4.3 Maintenance of Operating Facilities

Control of the gate valves, by-pass valves, blowoff valves and the intake screens in the upstream gate houses of both dams are the principal jobs associated with the maintenance of the operating facilities. High humidity in the gate houses results in the corrosion and rusting of the operating

equipment. This was apparent for the 48 inch diameter cast iron pipe in the lower gate house of the Nepaug Dam as well as for the water supply pipe in the service tunnel of the Phelps Dam (Appendix C, Photo 6, Page II-3B). There is no ventilation or dehumidification system at either dam site. With the exception of domestic light and power to the crane hoists there is no electric power requirements at either site.

4.4 Description of Warning System

There is no warning system at either of the dams.

4.5 Evaluation

The maintenance of the mechanical equipment for each dam is important in so far as the quality of the water is concerned. In spite of the fact that there are a few deficiencies in the valves of the piping system, the overall safety of each dam does not seem jeopardized.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data - The Nepaug Dam and the Phelps Brook Dam jointly impound the Nepaug Reservoir. The 175 foot spillway (actually five bays at 35 feet each) and 48 inch pipe at the Nepaug Dam and the 42 inch pipe at the Phelps Brook Dam are the only means of transmitting water past the dams.

A review of the calculations supplied by the MDC (Appendix B) indicates that the spillway is capable of passing the Probable Maximum Flood (PMF). The peak inflow is 35,300 cfs and the peak outflow is 23,000 cfs at a pond elevation of 494.4 (9.4 feet over the spillway). Using the guide curves supplied by the Corps of Engieners (rolling terrain) the PMF inflow into the reservoir is 41,470 cfs (1,300 cfs/sm x 31.9 sm). Although this number is greater than that used by the MDC, the guide curves are only approximate. The numbers for determining the PMF by the MDC are more accurate for this analysis. The MDC design flood flowed five feet over the spillway.

b. Experience Data - The floods to date experienced by these dams are November, 1927; March, 1936; September,

1938 and August and October, 1955 and the maximum flood was August, 1955. During this flood, the depth of flow over the spillway was 5.44 feet and the discharge was 8,350 cfs. According to observations at the time of the flood, the spillway was performing adequately, however, the dynamic forces caused by the flowing water vibrated the upper portion of the dam (the bridge over the spillway). These vibrations were minor and were determined not serious enough for study.

c. Visual Observations - The spillway and downstream channel of the Nepaug Dam at the time of inspection was in good condition. The spillway had just been recapped under contract by the Metropolitan District Commission. The Phelps Brook Dam does not have a spillway.

The 48 inch pipe through the Nepaug Dam is connected to the aqueduct that serves Hartford. The pipe also has a 24 inch blowoff which discharges into the channel just below the spillway. The pipe and its manually operated control gate are in good condition. The Phelps Brook Dam also has an outlet pipe that is connected to the Hartford aqueduct. The pipe is 42 inch in diameter with a 30 inch blowoff to a channel downstream. This pipe and its manually operated control gate are also in good condition. The pipe at each

dam can be used to drawdown the water level in Nepaug Reservoir, however, this is a slow process.

d. Overtopping Potential - The PMF will not overtop the dam. There is no critical section at the Nepaug Dam in that the top of the dam is at elevation 495.5 and during the PMF the pond rises to is elevation 494.4 (Appendix B). However, the top of Phelps Brook Dam is at elevation 494.5 and sandbagging its crest to elevation 495.5 will provide a uniform maximum elevation for the reservoir.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations - Since these dams are older (1914-1918), it is important to consider the history of their design and construction problems. There are photographs available at the Metropolitan District which show the various stages of progress during the construction of each dam. A review of the data assembled in 1971 just prior to the restoration work on the Nepaug Dam spillway shows that the concrete on the surface was of poor quality but that the interior concrete was in good condition. Since the repair, there does not seem to be any other visible cracking or spalling to the concrete face of the spillway or bridge over the top of the dam with the exception of the upstream face.

b. Design and Construction Data - After a thorough review of the project file for the Phelps Brook Dam, it was obvious that a slope stability analysis had not been done. At the time of design, this technique had not been developed for earth dams.

The gravity section for the Nepaug Dam was selected on the basis of study by F. P. Stearns, which compared the

gravity sections of other similar dams that had been built during that time. An analysis of this section was done to check its stability for the following conditions:

(1.) MDC Test flood elevation 487.5 and no ice thrust.

(2.) Water in reservoir at spillway elevation 482.5 with ice thrust of 20 tons/linear foot.

A summary of the results of this analysis is contained in (Appendix B, Reference 3) but all the resultants fall close to the kern point.

c. Operating Records - The water level of the Nepaug Reservoir is monitored at the intake chamber of the Phelps Brook Dam. Records show that for the storm of 1955 a head 5.45 feet was realized. The MDC design head of the spillway is 5.0 feet.

d. Post Construction Changes - The following changes to the Nepaug Dam facility have been noted since the completion of construction in 1918:

(1.) The appearance of efflorescence and lime formations as a result of seepage through the body of the dam. (Evidences appear in the inspection gallery, (Appendix C, Photos 9 and 10, Page II-5A).

(2.) Wash-out and replacement of retaining walls at the toe of the spillway.

(3.) Several "patch type" gunite projects for the exterior faces of the dam followed by a more permanent restoration project which was completed in 1976.

(4.) Erosion areas at the interface of the reservoir and the upstream face of the dam, (Appendix C, Photos 7 and 8, Page II-4A).

The following changes to the Phelps Brook Dam facility have been noted since completion of construction in 1917:

(1.) Replacement of the crane hoist system in the upper gate house.

(2.) Noticeable seepage flow at the outlet of the tile drain from the body of the dam. This flow carried out a reddish-brown silt material and was seen as far as 200 feet downstream, (Appendix C, Photo 7, Page II-4B).

(3.) Minor spalling of concrete on the exterior of the upper gate house, (Appendix C, Photos 5 and 6, Page II-3B).

e. Seismic Stability - The dams are located in Seismic Zone 1 and in accordance with recommended Phase I guidelines do not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - Considering the geological, design and construction data, the visual observations, the operating records, the post construction changes and the results of present inspection, it is concluded that the general condition of both dams and their appurtenant structures is good. The stability and reliability of the Phelps Brook dam, its slopes and foundation appears adequate. The Nepaug Dam, even though the spillway weir has just been repaired, will always be subject to wear and erosion. The structural stability of this section also seems adequate.

b. Adequacy of Information - The assessment of the condition of the dams can be based on the information avaiable as well as the visual inspection.

c. Urgency - The owner shall implement the recommendations and remedial measures described in the following sections within two to three years after receipt of this Phase I Inspection Report.

d. Need for Additional Investigation - There is no need for additional investigation.

7.2 Recommendations

It is recommended that the following actions be undertaken by the owner:

General

Continue the routine inspections of the dams that have been started by the Metropolitan District at a frequency of once in five years with special attention to the vulnerable spots of the dam; the seepage, joints, cracks and drains; the distresses of exterior concrete surfaces and movement of the embankment surfaces.

For the permanent monitoring of the dam behavior, the following instrumention, data collection and/or maintenance is suggested:

Nepaug Dam

(1.) Metering of the seepage discharge in the inspection gallery at the horizontal drains on the top of the stairwell at each end of the gallery and the total discharge in the gutter of the inspection gallery at the center of the spillway. The seepage water temperature should be measured each time and the frequency of these readings should be monthly.

(2.) Chemical analyses of the reservoir water (one probe) and the seepage water from the drains, joints and grouting pipes near the expansion joints (10 to 15 points) to evaluate the general amount of lime from the dam concrete and to monitor the internal corrosion of concrete. The frequency of these analyses should be once a year at a period of time when the maximum seepage discharges (approximately November - April) are realized. Water probes should be taken simultaneously with the metering of the seepage discharges. The water should be checked for pH, hardness, Ca, Mg, CO_3, HCO_3, Na + K and CO_2.

(3.) Photographs and sketches of the damaged surfaces of the upstream surface of the dam so that the areas and depth of these distresses can be recorded. It is suggested that periodically the level of reservoir water be lowered so that damages to these concrete zones can be observed and defined.

(4.) Visible cracks in the concrete of the dam should be marked on the drawings and the measuring of their width should be done, yearly.

(5.) Magnitude of vibration of the bridge over the spillway, top of the dam, the retaining walls and

floor of the inspection gallery during periods of heavy floods.

Phelps Brook Dam

(1.) Movements of the parapet walls relative to the upper gate house. The frequency of the readings should be yearly.

(2.) Seepage discharges through the body of the dam at the outlet of the concrete drain located at the downstream toe of the dam. The frequency of these readings should be monthly. It is also desirable to measure the temperature of the seepage water and periodically to measure the weight of the clay material from the dam body.

The frequency of the suggested monitoring should be increased if changes are detected. Detailed information on the field instruments, installation and operations is given in Reference 16. Any of the above recommendations that require additional investigation should be done by a qualified engineering firm.

7.3 Remedial Measures

It is considered important that the following items be attended to as early as practical:

a. Alternatives - Not applicable.

b. O & M Maintenance and Procedures -

Nepaug Dam

1. The downstream area should be cleaned as well as extension of the limits of riprap protection.
2. The deteriorated concrete on the upstream face of the non-overflow portions of the dam in the drawdown zones and the spalling concrete and damaged floor of the lower gate house should be repaired.
3. If other seepage spots appear on the downstream faces of the dam, the drainage wells of its body should be cleaned.

Phelps Brook Dam

1. Grass, brush and trees on the downstream slope below the Barnes Hill Road should be removed to facilitate the visual observation of existing and potential seepage.
2. The outlet for the concrete drain located at the downstream toe of dam should be cleaned of silt and should be equipped for metering seepage.
3. The damaged concrete corner of the exterior south wall of the upper gate house should be repaired.

General

Round-the-clock surveillance at both dams during periods of unusually heavy precipitation should be organized. The owner should also establish a formal system for warning downstream residents in case of emergency.

APPENDIX A

VISUAL INSPECTION CHECK LIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Nepaug Dam

DATE 6-6-78

TIME 9:30 - 2:00

WEATHER Sunny

W.S. ELEV. 482.1 U.S. 375.5± DN.S.

PARTY:

1. Richard Lyon
2. Miron Petrovsky
3. Gary Giroux
4. Peter Revill (MDC)
5. John Schearer
6.
7.
8.
9.
10.

PROJECT FEATURE	INSPECTED BY	REMARKS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Air Temperature 80°
Upstream Temperature 70° F
Seepage Water Temperature 47° F

PERIODIC INSPECTION CHECK LIST

PROJECT Nepaug Dam DATE 6-6-78

PROJECT FEATURE ____________ NAME R. Lyon

DISCIPLINE ____________ NAME G. Giroux

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	Good condition - new concrete
Current Pool Elevation	Cavitation on upstream side
Maximum Impoundment to Date	Good condition
Surface Cracks Pavement Condition	Downstream face, roadway surface and upstream face - numerous cracks-gunite work was done.
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good condition
Horizontal Alignment	Good condition
Condition at Abutment and at Concrete Structures	Gunite at abutment cracking and spalling
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	Not permitted
Sloughing or Erosion of Slopes or Abutments	N/A
Rock Slope Protection - Riprap Failures	N/A
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None
Foundation Drainage Features	N/A
Toe Drains	N/A
[illegible]	None

PERIODIC INSPECTION CHECK LIST

PROJECT Nepaug Dam

DATE 6-6-78

PROJECT FEATURE

NAME M. Petrovsky

DISCIPLINE

NAME J. Schearer

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channe	
Slope Conditions Bottom Conditions Rock Slides or Falls	None - Intake through wall of gate house
Log Boom	None
Debris	None observed
Condition of Concrete Lining	N/A
Drains or Weep Holes	N/A
b. Intake Structure	
Condition of Concrete	Good
Stop Logs and Slots	Stop logs of wood - in good condition

PERIODIC INSPECTION CHECK LIST

PROJECT Nepaug Dam — DATE 6-6-78

PROJECT FEATURE ____ — NAME R. Lyon

DISCIPLINE ____ — NAME M. Petrovsky

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	Gate house was reconditioned
Visible Reinforcing	None
Rusting or Staining of Concrete	None
Any Seepage or Efflorescence	None observed
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	Underwater (not observed)
Cracks	It was not possible to see into the gate house - full of water
Rusting or Corrosion of Steel	Sluice gate not seen - underwater
b. Mechanical and Electrical	
Air Vents	None
Float Wells	None
Crane Hoist	Electric hoist - new condition
Elevator	None
Hydraulic System	None
Service Gates	Sluce gate - underwater
Emergency Gates	Good condition - stop logs, cone valve 48"dia. & 24"dia. blowoff
Lightning Protection System	Valve for blowoff not used
Emergency Power System	Condition questionable
Wiring and Lighting System in [illegible]	Only domestic wiring for lights

PERIODIC INSPECTION CHECK LIST

PROJECT Nepaug Dam

DATE 6-6-78

PROJECT FEATURE

NAME G. Giroux

DISCIPLINE

NAME M. Petrovsky

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	
Rust or Staining on Concrete	48" diameter piep encased in the body of the dam
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Nepaug Dam

DATE 6-6-78

PROJECT FEATURE

NAME G. Giroux

DISCIPLINE

NAME R. Lyon

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Good
Rust or Staining Spalling Erosion or Cavitation Visible Reinforcing Any Seepage or Efflorescence	Some staining and spalling inside gate house but otherwise in good condition
Condition at Joints	Good
Drain holes	N/A
Channel	
Loose Rock or Trees Overhanging Channel	See spillway outlet channel
Condition of Discharge Channel	

PERIODIC INSPECTION CHECK LIST

PROJECT Nepaug Dam DATE 6-6-78

PROJECT FEATURE NAME G. Giroux

DISCIPLINE NAME J. Schearer

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	Underwater
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	Good condition
Rust or Staining	None observed
Spalling	None
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Not detected
Drain Holes	None
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Some scouring among heavy riprap slope protection
Other Obstructions	None

PERIODIC INSPECTION CHECK LIST

PROJECT Nepaug Dam

DATE 6-6-78

PROJECT FEATURE

NAME R. Lyon

DISCIPLINE

NAME G. Giroux

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	
Bearings	R. C. Bridge over spillway
Anchor Bolts	
Bridge Seat	
Longitudinal Members	Good condition
Under Side of Deck	Repaired - good condition
Secondary Bracing	
Deck	
Drainage System	Good
Railings	Excellent
Expansion Joints	Good
Paint	N/A
b. Abutment & Piers	
General Condition of Concrete	Good - new gunite on piers
Alignment of Abutment	Good
Approach to Bridge	Good
Condition of Seat & Backwall	N/A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Phelps Brook Dam

DATE 6-8-78

TIME 9:30 - 2:00

WEATHER Cloudy

W.S. ELEV. 402.1 U.S. 388.± DN.S.

PARTY:

1. Richard Lyon
2. Gary Giroux
3. Miron Petrovsky
4. Peter Revill (MDC)
5. John Schearer
6.
7.
8.
9.
10.

PROJECT FEATURE	INSPECTED BY	REMARKS
1.		
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10.		

Remarks: East Dike for the Nepaug Reservoir is not in our Contract.

Air Temperature 75° F
Upstream Temperature 70° F
Seepage Water 45° F

PERIODIC INSPECTION CHECK LIST

PROJECT Phelps Brook Dam DATE 6-8-78

PROJECT FEATURE ____________ NAME R. Lyon

DISCIPLINE ____________ NAME M. Petrovsky

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	Good
Current Pool Elevation	Good
Maximum Impoundment to Date	Good
Surface Cracks	None observed
Pavement Condition	Good
Movement or Settlement of Crest	None observed
Lateral Movement Vertical Alignment Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good some settlement at upper gate house
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Not permitted
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	Downstream seepage measured (see attached sheet)
Piping or Boils	None
Foundation Drainage Features	N/A
Toe Drains	None
[illegible]	None

PERIODIC INSPECTION CHECK LIST

PROJECT Phelps Brook Dam

DATE 6-8-78

PROJECT FEATURE

NAME M. Petrovsky

DISCIPLINE

NAME J. Schearer

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	Underwater
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	Good
Stop Logs and Slots	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Phelps Brook Dam

DATE 6-8-78

PROJECT FEATURE

NAME M. Petrovsky

DISCIPLINE

NAME G. Giroux

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	Some on outside face below water line
Visible Reinforcing	Not observed
Rusting or Staining of Concrete	None
Any Seepage or Efflorescence	Minimal
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	Underwater concrete - good
Cracks	Minor hairline cracks
Rusting or Corrosion of Steel	None
b. Mechanical and Electrical	
Air Vents	None
Float Wells	
Crane Hoist	New Hoist
Elevator	None
Hydraulic System	None
Service Gates	Underwater
Emergency Gates	None
Lightning Protection System	None
Emergency Power System	None
Wiring and Lighting System in A-12	None

PERIODIC INSPECTION CHECK LIST

PROJECT Phelps Brook Dam DATE 6-8-78

PROJECT FEATURE ______ NAME R. Lyon

DISCIPLINE ______ NAME G. Giroux

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Good
Rust or Staining on Concrete	Small amount near expansion joints and floor of conduit
Spalling	None
Erosion or Cavitation	None (Water flow in 42"dia. pipe)
Cracking	Minor
Alignment of Monoliths	Good
Alignment of Joints	Good
Numbering of Monoliths	7 ±

APPENDIX B

All references except Nos. 12, 13, 14, 15 and 16 are located at the M.D.C. Headquarters, 555 Main Street, Hartford, Connecticut.

1. "Specifications for the Construction of the Nepaug Dam". Contract 5; The Metropolitan District; Hartford County, Connecticut; 1914.

2. "Specifications for the Construction of the Phelps Brook Dam". Contract 6; The Metropolitan District; Hartford County, Connecticut; 1914.

3. Nepaug System. Reports of Consultants; the Metropolitan District in Hartford County, Connecticut; 1912-1914.

4. "Nepaug and Phelps Brook Dams". Questionnaire for outlets with selective withdrawal provisions; Water Bureau of the Metropolitan District; Hartford County, Connecticut.

5. "Nepaug and Phelps Brook Dams". Inspection of Water Bureau Facilities; the Metropolitan District; Hartford County, Connecticut.

6. "Nepaug Dam". Boring logs and Concrete Test Reports by Clarence Welti Associates, Inc.; The Metropolitan District; Hartford County, Connecticut; June-July, 1971.

7. "Nepaug Dam". Preliminary Inspection Report by Joseph A. McElbey; The Metropolitan District; Hartford County, Connecticut; August, 1971.

8. "Nepaug Dam". Investigation of Concrete Condition at Roadway; Drilling Concrete Cores; Testing Hardened Concrete Core (ASTM C42-64), and Petrographic Studies of Concrete Cores by the Haller Testing Laboratories, Inc.; The Metropolitan District; Hartford County, Connecticut; October, 1971; December, 1971; January, 1972; February, 1972.

9. "Nepaug Dam". Stability Analysis; Summary Table; The Metropolitan District; Hartford County, Connecticut; January, 1972.

10. "Nepaug Dam Improvements" by Peter J. Revill; The Metropolitan District; Hartford County, Connecticut; March, 1976.

11. "Data on Safety of Metropolitan District Dams". The Metropolitan District; Hartford County, Connecticut.

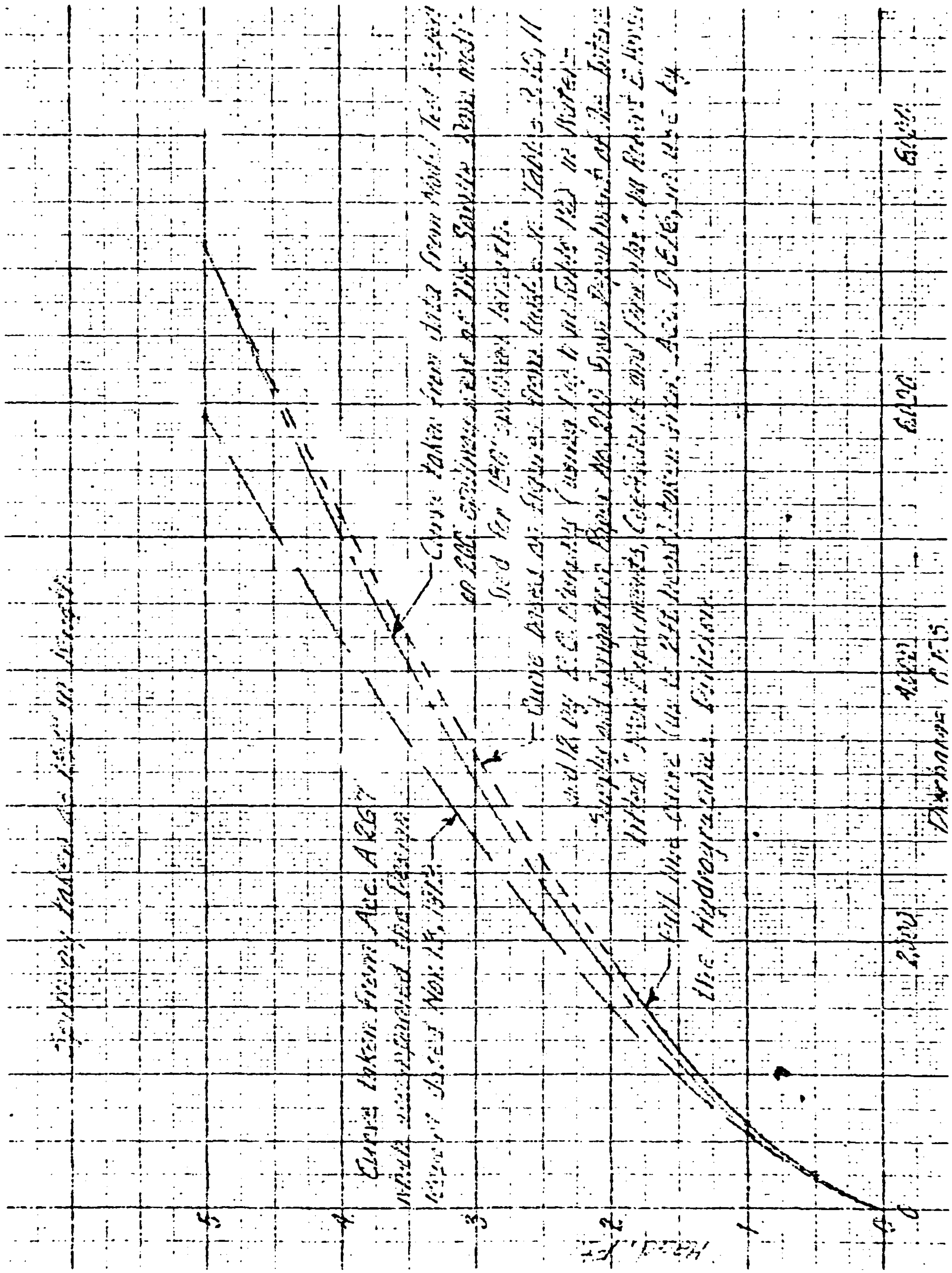
12. Recommended Guidelines for Safety Inspection of Dams. Department of the Army; Office of the Chief of Engineers; Washington, D.C.; November, 1976.

13. "Guide Curves for the Probable Maximum Flood (PMF) for Regions of New England" based on past Corps of Engineers Studies; March, 1978.

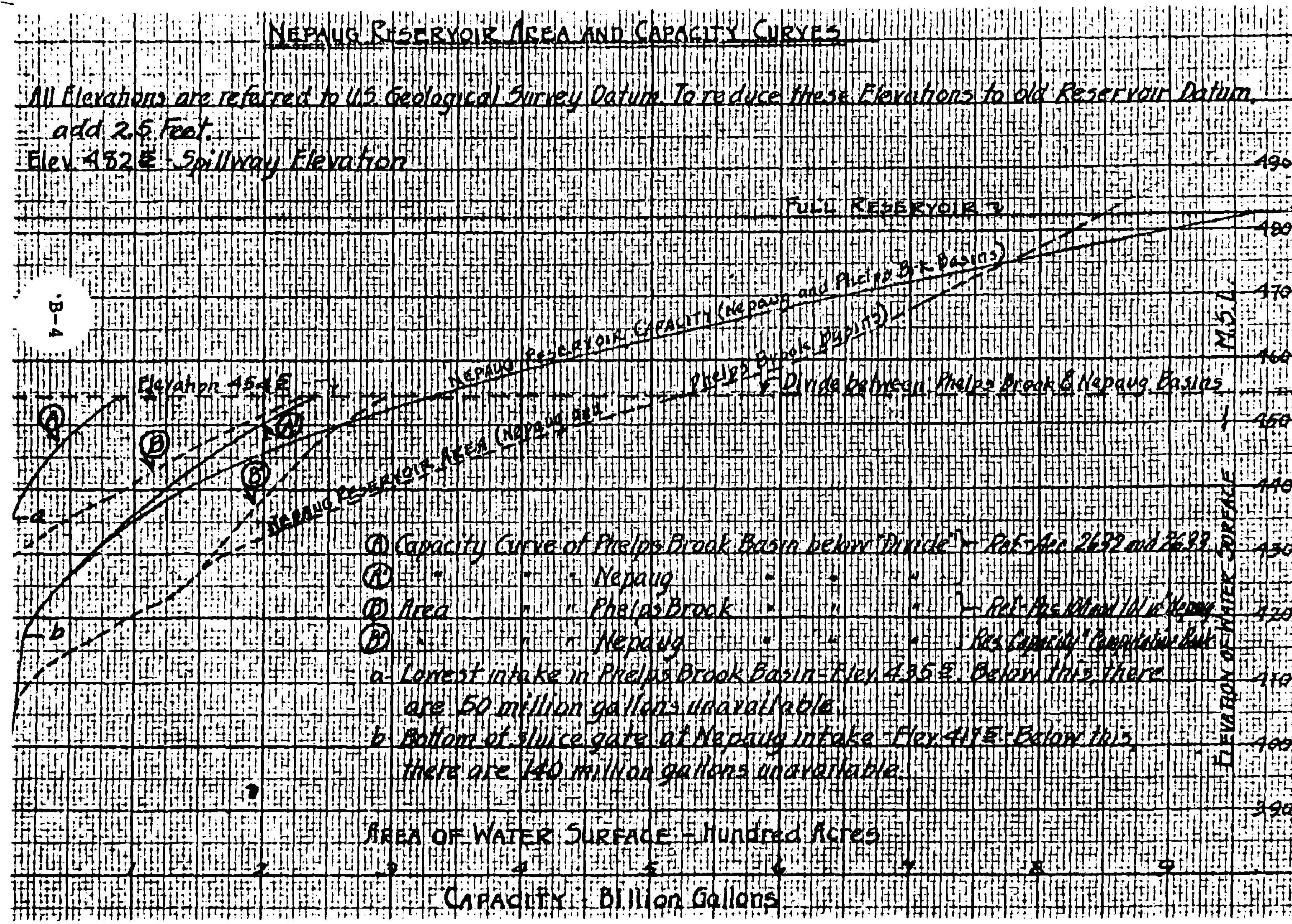
14. "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations". New England Division; Corps of Engineers; March, 1978.

15. Rule of Thumb. Guidance for Estimating Downstream Dam Failure Hydrographs; Corps of Engineers; April, 1978.

16. "Instrumentation of Earth and Rockfill Dams", EM 1110-2-1908; 31 August 1971; Department of the Army; Corps of Engineers.



COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION



COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

Purpose

To estimate behaviour of reservoir during largest conceivable flood with hydrograph similar to that for flows of Aug 18 and 19, 1955

Largest conceivable flood - rainfall

From Acc. H-2694.2, use 32" or $\frac{32}{13.8} = 2.3$ amount which fell at Phelps Brook in Aug 1955 storm.

Largest conceivable flood - runoff

The Nepaug watershed is, as discussed in Acc. H-2691.36, and as can be observed in H-2691.35, a sluggish one as far as response to rainfall is concerned, yet continued rainfall appears to hasten this response. Presumably the hydrograph for the maximum conceivable flood would be more sensitive to rainfall fluctuations than that for Aug. 1955, yet to attempt to estimate this difference is virtually impossible. To allow for this factor, the flood flows for Aug 1955 are increased to 2.5 their original value. This gives a peak flow of 2.5 × 445 or 1,110 c.f.s/sq.mi. which should be amply conservative.

Note that the ratio of $\frac{1955}{1938}$ flood peaks are for:-

Barkhamsted $\frac{735}{162} = 4.5$ Nepaug $\frac{445}{97} = 4.6$.

Rainfall was, in 1938, greater at Barkhamsted than Nepaug, in 1955 probably the same way. However, in 1955, Barkhamsted would be flashier than in 1938 because in the latter year there was no pond of any extent to make half the watershed almost instantly responsive to rainfall*. Therefore the Barkhamsted ratio would be higher, logically, than Nepaug, and the reason that it is not is that the lagging effect of pondage and ground water absorbtion on Nepaug watershed decreases with increasing rainfall. Thus the increase of runoff ratio to 2.5 for maximum conceivable flood is justified, apparently.

COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

Spillway discharge

For water Elev 485 to 490, the curve shown on Acc. H-2691. 13 is used.

Above Elev. 490, the bridge spandrels block off some of the water, at Elev. 495.5 the discharge is comparable to that for an orifice.

In order to obtain some sort of a discharge curve, two procedures are adopted:

a) From Elev. 490 to 495.5, using C_d from extrapolated curve on Acc. H-2691. 13, obtain discharge without spandrel, then reduce this by proportion of area blocked by bridge

b) From Elev. 495.5 and above, use an orifice discharge formula.

Blend (a) and (b)

a) Extension of weir discharge. Q=C...

Water Elev.	Water head	Free water area (one bay)	Actual water area (one bay)	Ratio $\frac{\text{Actual}}{\text{Free}}$ area	C_D	Virtual C_D	Discharge c/s
490	5	~	~	1.0	3.63	3.63	7,300
492	7	248	242	0.98	3.66	3.58	11,700
494	9	319	291	0.92	3.68	3.38	16,400
495.5	10.5	372	309	0.83	3.70	3.06	18,700

Weir length taken as 180'. Length between bridge piers, 35.5' as scaled from Dwg Acc. 163.

b) Orifice discharge

Water at Elev 495.5. Area of waterway per bay 309 sq ft (from above table). Approx. centre of waterway at Elev. 489.5. Assume coefficient of discharge of 0.7 [1 side rounded], then total flow = $5 \times 309 \times 0.7 \sqrt{2g \times 6}$ = 21,200 c.f.s

For water at Elev. 497.5, Q = 24,400 c.f.s

Values plotted on graph below.

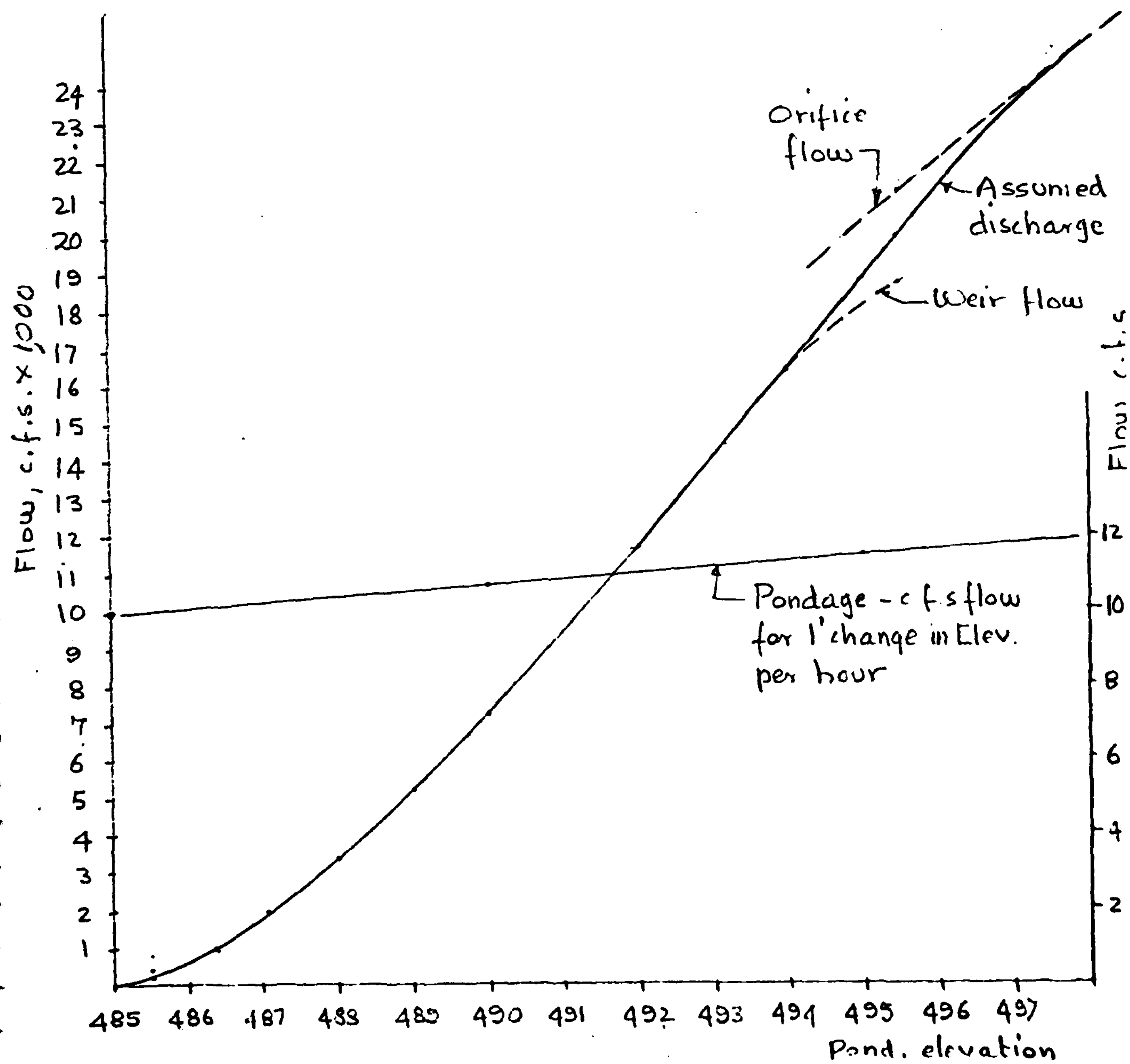
Reservoir capacity

What is required is c.f.s. inflow required to produce a 1ft. rise per hour for different reservoir elevations.

From Acc. H-2691-13, accepting extension of curve shown, at Elev. 480, capacity per foot = 0.26 Billion gallons

485	= 0.27	"	"
490	= 0.29	"	"

Now 1 Billion gallons per hour = 37,111 c.f.s.



COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

Reservoir elevations for flood of 2½ intensity of runoff for flood of Aug 1955.

Initial pond Elev. 485·00

	Time, hr ending	Inflow * c.f.s	Pond elevation: End of period	Pond elevation: Rise in pond	Spillway Q (aver. pond elev)	Pondage.	Total inflow (check)
Thursday	4 AM	-	485·00				
	8	670	485·26	0·26	50	650	700
	NOON	1130	485·63	0·37	200	925	1125
	2 PM	2150	485·97	0·34	400	1,740	2140
	4	4070	486·59	0·62	900	3,160	4060
	6	4180	487·09	0·50	1600	2,570	4170
	8	3930	487·43	0·34	2200	1750	3950
	10	3930	487·67	0·24	2650	1,250	3900
	MIDNT	5320	488·09	0·42	3150	2,190	5,340
Friday	2 AM	8800	488·95	0·86	4360	4,440	8,800
	3	11,800	489·53	0·58	5,700	6,100	11,800
	4	17,700	490·51	0·98	7,300	10,500	17,800
	5	21,900	491·64	1·13	9,600	12,300	21,900
	6	28,300	493·06	1·42	12,600	15,600	28,200
	7	19,000	493·45	0·39	14,700	4,350	19,050
	8	19,500	493·81	0·36	15,500	4,000	19,500
	9	26,100	494·63	0·82	17,000	9,180	26,180
	10	35,300	496·00	1·37	19,600	15,700	35,300
	11	29,200	496·57	0·67	22,000	7,200	29,200
	NOON	25,700	496·90	0·23	23,000	2,700	25,700
	1	22,500	Drops				
	2	22,100					
	3	18,900					
	4	16,800					
	5	14,000					
	6	12,700					
	7	10,400					
	8	10,000					

Comment

Top of [illegible] Dam, Elev. 497·5?

" " East Dike Elev. 497·0

* 2½ [illegible] Qin from [illegible] H26[illegible]

Conclusions

1. Maximum conceivable rainfall 32".

2. Maximum conceivable runoff 1,110 c.f.s /sq mi.

3. For notes about "conceivable", see Acc H-2694.13

4. Maximum flood would come about level with top of Phelps Brook Dam and the East Dike. Sandbagging crests of these structures might be essential to preserve them.

The Metropolitan District
artford County, Connecticut
Water Bureau
Designing Division

Des. Div. Ref. No. S- 1402
Date 9-27-73

INSPECTION OF DAMS AND SPILLWAYS

NAME OF DAM Nepaug Dam

LOCATION (Town, River, Reservoir) New Hartford

INSPECTORS	Name	Title	Div./Dept.
	Dick Allen	Assistant Engineer	S & P
	Dick Conopask	Senior Engineer	Design

In filling out this form, please enter full information on conditions, and on location of any defects.

A. GENERAL

1) Were any photographs taken of the dam during this inspection Yes
2) Reservoir level, Elev. 479.77
3) Weather (including comment on humidity) Sunny, cool, dry (Beautiful fall day)

B. EARTH DAMS

1) Note any depressions in crest
2) Slides and/or erosion, upstream face
3) Slides and/or erosion, downsteam face
4) Cracks in embankment

5) Surfacing on crest and condition ______

6) Condition of parapet walls, if any ______

7) Seepage on downstream face, especially at toe, (location and quantity) ______

8) Soft ground at toe (locate) ______

9) Signs of settlement at gate house and/or gate house bridge ______

10) Downstream drainage system (clear or blocked, etc.) ______

11) Type and condition of downstream face planting ______

12) Is planting and/or debris etc. a fire hazard? ______

13) Do plantings obscure toe of dam and other points where monitoring inspection is necessary? ______

14) Damage or vandalism (to lights, plaques, etc.) ______

15) Other ______

C. CONCRETE DAMS

1) Any signs of motion Bituminous paving at construction joints is cracked, expansion & contraction (normal).

2) Deterioration noted:

Upstream face None observed, water level high

Downstream face Extreme cracking, some spalling (See picture #1)

Road/walk on crest Fair

Parapets Cracking, spalling - 100' of parapet southwest section fallen section (See pictures #1 and #2)

Spillway (Extreme cracking & spalling on steps, moderate cracking in wier

Other (excluding gate houses) __________

3) Inspection Gallery:

General condition Good

Leakage Moderate

Lime accumulation Severe in some weep holes (See picture #7)

Flooding & drainage no flooding but drains should be cleaned

Other Lime deposits should be cleaned from walls, gutters and weep holes, (See pictures #7 and #8) deposits should be monitored regularly.

4) Damage or vandalism (to lights, plaques, etc.) Plaque rosettes missing, door to U. G. House damaged, C. B. grate missing.

5) Other comments Evidence of deterioration everywhere.

D. GATE HOUSES

i) Upper House

1) Exterior: walls Poor - cracked and spalled

windows Poor - glass missing (2) 3 boarded up

doors Poor

roof Fair

2) Superstructure Interior:

walls Poor - cracked

floor Good - stop log well boards fair

ceiling Fair - Poor

3) Leakage into superstructure Minimal

4) Substructure, interior:

Leakage and condensation Moderate - lime deposits on north and east walls

Condition of metal work (stairs, etc.) stairs & grating, Good - Structural beams & columns, Poor

5) Equipment condition:

Sluice gates Good

Gate valves -

Piping -

Electrical gear None

Other Gearing on sluice gate rusty (See picture #3)

6) Do all electric lights work Yes

7) Condition of stop logs in storage well Good ?

8) Operating personnel comments on functional condition of all equipment (valves, hoists, selector gates, trash racks, screens, etc.)

Good

9) Last time various wells and other underwater portions were unwatered and examined (Give name of well and date in case of multiple wells).

January, 1963

10) Other comments Better housekeeping necessary

ii) Lower House

1) Exterior: walls Fair, settlement cracks around door

windows Boarded closed

doors Good

roof Fair

2) Superstructure Interior:

walls Good - interior sandbagged to prevent roof collapse should parapet fall (See Picture #4)

floor Good

ceiling Good

3) Leakage into superstructure Minimal

4) Substructure, interior:

Leakage and condensation Minimal

Condition of metal work (stairs, etc.) None

5) Equipment condition:

Sluice gates

Gate valves Good

Piping Good

Electrical gear None

Other Cone valve - Good

6) Do all electric lights work No electric lights

7) Condition of stop logs in storage well None

8) Operating personnel comments on functional condition of all equipment (valves, hoists, selector gates, trash racks, screens, etc.)

o.k.

9) Other comments Spalling on exterior stairs

iii) Conduit between gate houses

1) Concrete condition

2) Leakage

3) Condition of metal work and piping

4) Other comments

E. PRINCIPLE SPILLWAY

(If spillway is part of dam, enter information in C only).

1) Weir

2) Channel

3) Outlet of channel

4) Note any obstructions to flow

5) Bridge

6) Is water spilling

7) Other comments

F. EMERGENCY SPILLWAY

1) Channel

2) Obstructions

3) Other comments

G. APPURTENANT STRUCTURES

List structure (such as stilling pools, discharge weir structures, stream diversion works, etc. and give conditions.

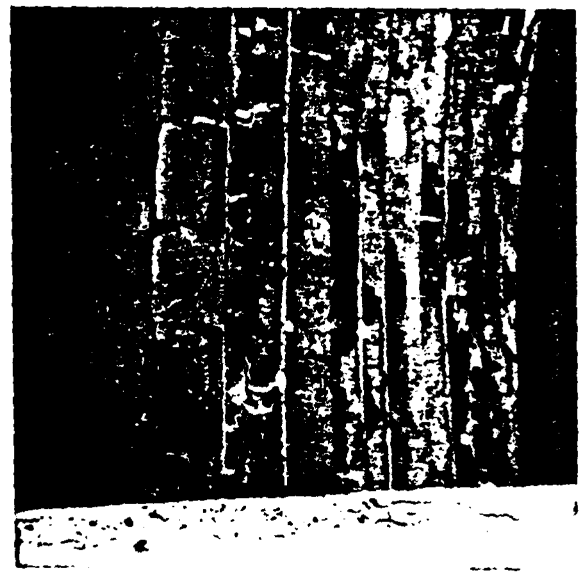
Stilling pool - o.k.

Nepaug River Weir - Generally o.k. - Floor boards on walkway could be replaced and railing painted.

H. OVERALL ASSESSMENTS

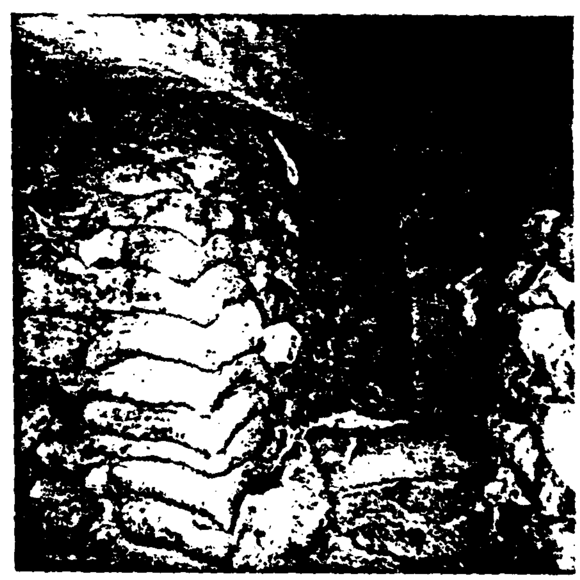
Is this dam with its appurtenances maintained in a condition satisfactorily to the Inspectors? Operating equipment satisfactory - Basic dam structure needs major renovation. Upper Gate House needs major renovation - Lower Gate House - o.k. This renovation requires more than normal maintenance procedures.

#1 Downstream side of dam and spillway in poor condition.



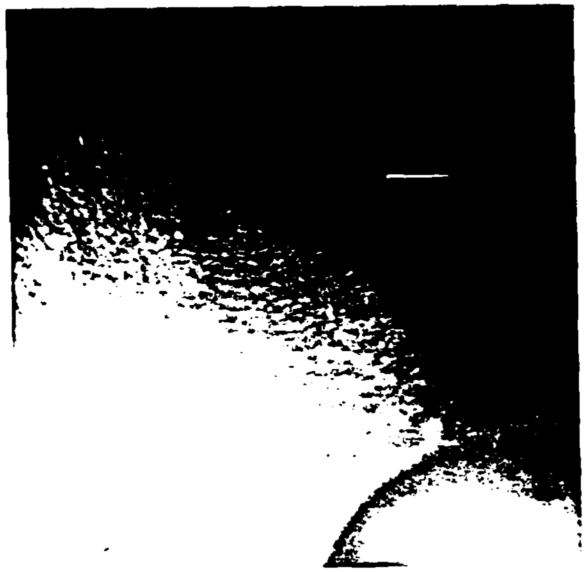
#2 Spillway steps are in very poor condition.

#3 Sluice gate gearing rusty in Upper Gate House.



#4 Sandbags around valves and for roof support in Lower Gate House.

#5 Example of clean weep hole for comparison in Inspection Gallery.



#6 Weep hole showing some lime deposits.

#7 Weep hole with excessive lime deposits. This hole is square.

#8 Lime deposits on ceiling and walls of Inspection Gallery.

NEPAUG DAM

PRELIMINARY INSPECTION REPORT
BY
JOSEPH A. McELROY

AUGUST 1971

1. PURPOSE. This report records inspection observations of the concrete at the Nepaug Dam and Reservoir, Collinsville, Connecticut. The inspection was performed at the request for assistance of Mr. Henry Philips, Executive Engineer, Water Bureau, Metropolitan District, Hartford, Connecticut. The following MDC personnel participated in the inspection:

Mr. Lawrence Johnson - Chief Design Engineer
Mr. Henry Philips - Executive Engineer
Mr. Michael Long - Research Engineer
Mr. Peter Revill - Project Engineer

2. GENERAL. Exterior and interior concrete in the dam was inspected. In general, the exterior concrete is in poor to fair condition, and the interior concrete is considered to be in good condition. Concrete distress is considered superficial. The dam has been renovated several times by removing about 6 inches of the downstream face of deteriorated concrete and applying pneumatically placed concrete. The road surface has also been replaced. The sidewalk on the downstream side has been changed in width to accommodate the change in width of the road. The upstream side which is curbed has not been altered in width. A plastic coating has been applied to some portions of the GUNITE. A detailed crack survey was not made and it was difficult to determine structural

cracks requiring mandatory repair from surface cracks, which although important to the life of the structure, are not as critical.

3. ROADWAY SECTION. The major distress was noted in the parapet wall areas of the roadway. Two sections of the upstream face, east side, have failed and fallen into the reservoir. The remaining parapet wall sections on the upstream side of the dam are in a state of failure and extreme care should be exercised on the demolition. Examination of the concrete road surface slab indicates that the parapet walls have moved relative to the centerline of the road. The walls on the upstream side have moved about 1-1/2 inches and the walls on the downstream side have moved approximately 1/2 inch. This movement has been caused by water seeping down the vertical construction joints between the curb and sidewalk, and roadway slab section of the road. The water has carried salt, sand, and other detritus into the crack and during the winter months the freezing action has progressively jacked the crack open. Repeated cycles of freezing and thawing and the filling of the wider and deeper crack has progressed until sufficient leverage has been developed to split the concrete. The upstream face with the permanently located curb experiences the most concentrated jacking effort. Observation of the sheared surface showed that the dirt and detritus has penetrated the concrete to a depth of about 18 inches. This poses the problem of determining the progressive deterioration on the opposite or downstream side which shows only 1/2 inch of movement. This different movement is probably the result of changing the width of the sidewalk

which changed the location of the construction joint and consequently the area of attack. Examination of cores removed from the roadway section indicate that there is approximately four feet of very disintegrated (uncoreable) concrete under the roadway. Manifestation of this condition is not in evidence on the sheared parapet wall sections of the roadway where it would be expected and compressive strength of recoverable core sections show adequate strengths. Therefore, this conclusion of concrete deterioration may be caused by either faulty coring operation or core diameters too small to adequately core the cyclopean concrete. Inasmuch, in my opinion, as the depth of deteriorated concrete in the roadway is questionable; it has been recommended that a longitudinal line of six inch diameter cores be taken on the north side straddling the existing curb and at the location of the original curb. In addition, it is suggested that a transverse line of cores be taken on the east and west side of the dam to determine if the damage is uniform relative to the width of the road. The recommended layout of the suggested additional cores was left in the Hartford office.

4. GATEHOUSES. Concrete in the gatehouses is fair, but show structural cracks which should be repaired by the epoxy resin injection method as employed by the Adhesive Engineering Company, Lawrence, Massachusetts. Leakage from the roadway is in evidence.

5. SPILLWAY. Concrete in the spillway section which has been GUNITED approximately five years exhibits numerous cracks. It is assumed that most of these are shrinkage cracks and penetrate only to the full depth of the repair - about six inches in most instances. Surface weathering

will cause progressive deterioration. The steps of the spillway show more cracking and moderate spalling. Underside of the road arch in the spillway overflow section show map cracking which is especially noticeable in the vicinity of the joints and drains.

6. NON-OVERFLOW SECTIONS. Concrete in the non-overflow sections downstream side which have been GUNITED show similar cracking conditions and progressive deterioration is to be expected. The bonding properties of the GUNITE to the old existing concrete should be checked.

7. INTERIOR SECTION. Concrete in the interior of the dam is in very good condition and no distress or significant cracking was noted.

8. RECOMMENDATIONS.

a. It is recommended that the coring program as outlined be completed and the concrete closely examined to determine depth of damage. The method of repair could be determined by this significant evaluation.

b. It is recommended that all structural cracks be repaired by the epoxy resin injection method.

c. It is recommended that the bond between the GUNITE application and the old existing concrete be evaluated.

9. CONSIDERATIONS.

a. If the previous coring data accurately reflects the depth of damage (4 feet) it will be necessary to completely remove the parapet walls on both sides of the road and the top of the road surface to sound concrete.

b. If the concrete in the road section is damaged to only a depth of approximately one foot, as would normally be expected of non-air-entrained concrete, it may be possible to save the downstream parapet walls and repair the road deck. The upstream parapet walls are not salvageable. It is suggested that demolition of these walls consider the non-vibratory method of burning to reduce the size of the sections removed (data attached).

c. An epoxy resin bonded high quality high air-entrained concrete should be considered for the repair. Bonding method dependent upon investigative factors.

d. If repair of the downstream face is contemplated, a new face section constructed by slip form rapid method of construction could be considered. This method would have the advantage of eliminating the horizontal construction joints and is rapid if a short construction period is required.

e. Economic feasibility of the methods should be considered but should not override to the technoligical considerations and subsequently the anticipated life of the structure.

f. The consultants engaged should be familiar with the materials and processes involved and should follow the process of the work.

g. A detailed crack condition survey should be made to distinguish the type and scope of cracking and all structural cracks should be repaired by the epoxy injection method. Additional cracks should be repaired by this method or alternate method depending upon

the scope of other repairs. However, regardless of the type and extent of additional repairs structural cracks should be repaired prior to any other repair or treatment.

The Metropolitan District
Hartford County, Connecticut
Water Bureau
Designing Division

Des. Div. Ref. No. S- 1403
Date 9-27-73

INSPECTION OF DAMS AND SPILLWAYS

NAME OF DAM Phelps Brook Dam

LOCATION (Town, River, Reservoir) Nepaug Reservoir

INSPECTORS	Name	Title	Div./Dept.
	Dick Allen	Assistant Eng.	S & P
	Dick Conopask	Senior Engineer	Design

In filling out this form, please enter full information on conditions, and on location of any defects.

A. GENERAL

1) Were any photographs taken of the dam during this inspection Yes

2) Reservoir level, Elev. 479.77

3) Weather (including comment on humidity) Sunny, cool, dry (Beautiful fall day)

B. EARTH DAMS

1) Note any depressions in crest None

2) Slides and/or erosion, upstream face None

3) Slides and/or erosion, downsteam face None

4) Cracks in embankment None

5) Surfacing on crest and condition

Fair to Good (see Picture #1)

6) Condition of parapet walls, if any None

7) Seepage on downstream face, especially at toe, (location and quantity)

East natural embankment in large bolder area (see below)

8) Soft ground at toe (locate) None

9) Signs of settlement at gate house and/or gate house bridge

Bridge settled some at both ends

10) Downstream drainage system (clear or blocked, etc.) Clear

11) Type and condition of downstream face planting Grass - excellent.

Hemlock row beyond toe - o.k.

12) Is planting and/or debris etc. a fire hazard? No.

13) Do plantings obscure toe of dam and other points where monitoring inspection is necessary? Generally no, however low overhanging branches & brush should be trimmed along north downstream toe.

14) Damage or vandalism (to lights, plaques, etc.) None

15) Other Concrete stair on downstream face - top of stringers is spalled to reinforcement in several areas.

C. CONCRETE DAMS

1) Any signs of motion

7. Area covered with trees & brush - moist earth with apparent running water. Condition probably due to area being heavily shaded by trees, bolders and being on east slope. Surface water does not evaporate readily. This area should be monitored twice yearly following dry spells.

2) Deterioration noted:

Upstream face ______

Downstream face ______

Road/walk on crest ______

Parapets ______

Spillway ______

Other (excluding gate houses) ______

______

3) Inspection Gallery:

General condition ______

Leakage ______

Lime accumulation ______

Flooding & drainage ______

Other ______

______

4) Damage or vandalism (to lights, plaques, etc.) ______

______

5) Other comments ______

______

______

D. GATE HOUSES

i) Upper House

1) Exterior: walls Generally Excellent* - See picture #2

windows Excellent

doors Excellent

roof Excellent

* 1 crack & spalled area at east railing. East rail has settled.
1 area of spalling in south belt course.

2) Superstructure Interior:

walls Excellent - paint peeling somewhat

floor Excellent

ceiling Excellent - paint peeling somewhat

3) Leakage into superstructure None

4) Substructure, interior:

Leakage and condensation

Condition of metal work (stairs, etc.)

5) Equipment condition:

Sluice gates Good

Gate valves -

Piping

Electrical gear Crane motor o.k.

Other

6) Do all electric lights work No lights

7) Condition of stop logs in storage well O.K.

8) Operating personnel comments on functional condition of all equipment (valves, hoists, selector gates, trash racks, screens, etc.)

O.K.

9) Last time various wells and other underwater portions were unwatered and examined (Give name of well and date in case of multiple wells).

March, 1966

10) Other comments

ii) Lower House

1) Exterior: walls Excellent

windows Excellent, one broken

doors Excellent

roof Excellent

2) Superstructure Interior:

walls Good - crack in south wall at window sill level

floor Good - top of south floor beam shattered

ceiling Good

3) Leakage into superstructure Minimal

4) Substructure, interior:

Leakage and condensation Minimal

Condition of metal work (stairs, etc.) Ladder rungs and structural steel need painting.

5) Equipment condition:

Sluice gates

Gate valves Main valve works hard; replace bonnet and stuffing box bolts on all valves - See picture #3

Piping Good - replace all bolts on all flanged joints.

Electrical gear Conduits O.K. Flow meter o.k.

Other

6) Do all electric lights work Yes

7) Condition of stop logs in storage well

8) Operating personnel comments on functional condition of all equipment (valves, hoists, selector gates, trash racks, screens, etc.)

Main valve works hard

9) Other comments red sludge & misc. lumber, pipes, etc. on floor should be cleaned out.

iii) Conduit between gate houses

1) Concrete condition Sides & roof - excellent; floor - not able to be inspected because of sludge accumulation (See pictures #4 & #5)

2) Leakage minor from roof & walls - moderate with deposits from plug @ upper G.H.

3) Condition of metal work and piping Generally good - some rusting and minor joint leakage at a few joints* (See picture #6)

4) Other comments Several inches of red sludge has accumulated on floor of conduit. (See picture #7). This should be removed now and at least once each year to prevent large accumulations from polluting Farmington River.

E. PRINCIPLE SPILLWAY

(If spillway is part of dam, enter information in C only).

1) Weir

* All wood blocking at concrete pipe supports is rotten and must be replaced as soon as possible (See picture #8.)

2) Channel ______

3) Outlet of channel ______

4) Note any obstructions to flow ______

5) Bridge ______

6) Is water spilling ______

7) Other comments ______

F. <u>EMERGENCY SPILLWAY</u>

1) Channel ______

2) Obstructions ______

3) Other comments ______

G. <u>APPURTENANT STRUCTURES</u>

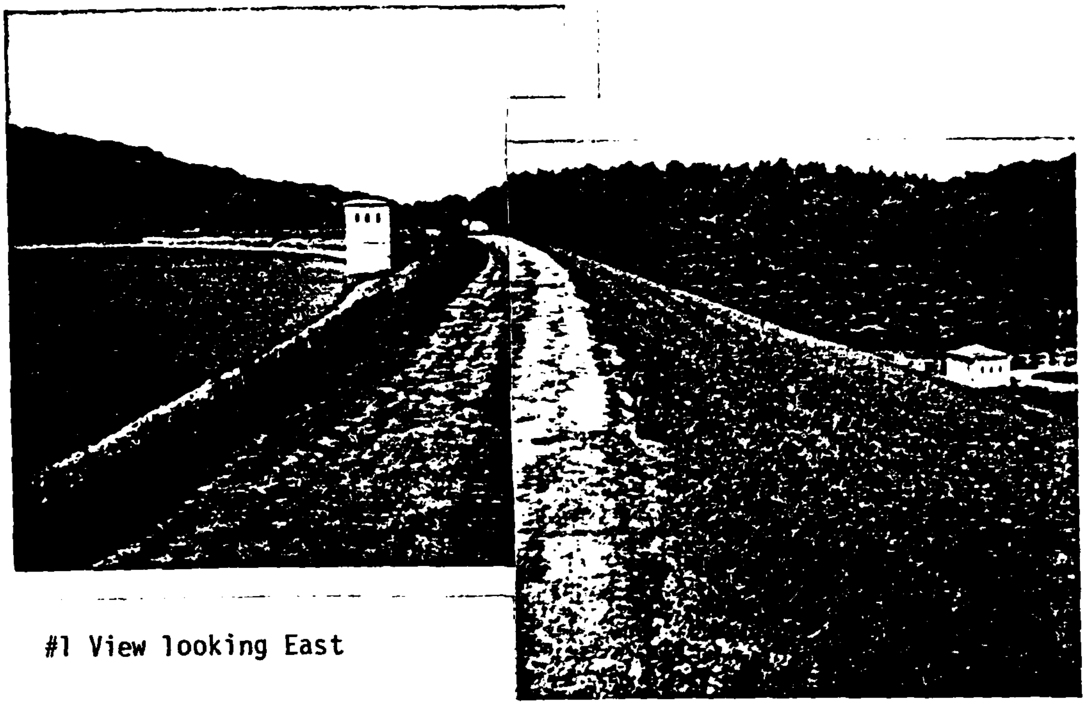
List structure (such as stilling pools, discharge weir structures, stream diversion works, etc. and give conditions.

Blow-off channel overgrown - o.k. as is.

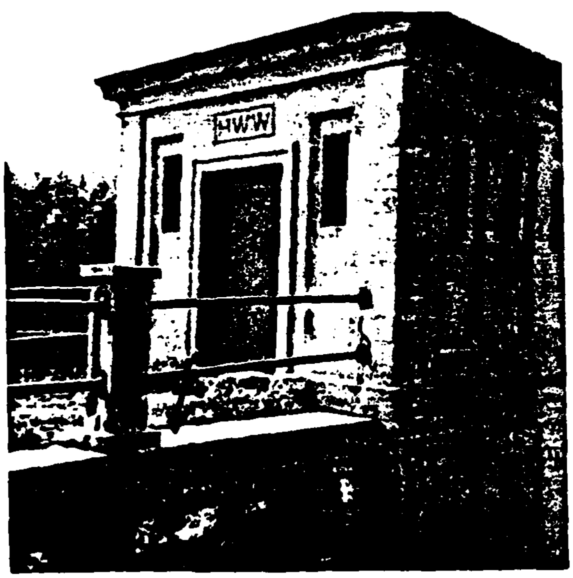
H. OVERALL ASSESSMENTS

Is this dam with its appurtenances maintained in a condition satisfactorily to the Inspectors? Exterior, excellent; lower gate house floor and conduit floor need cleaning.

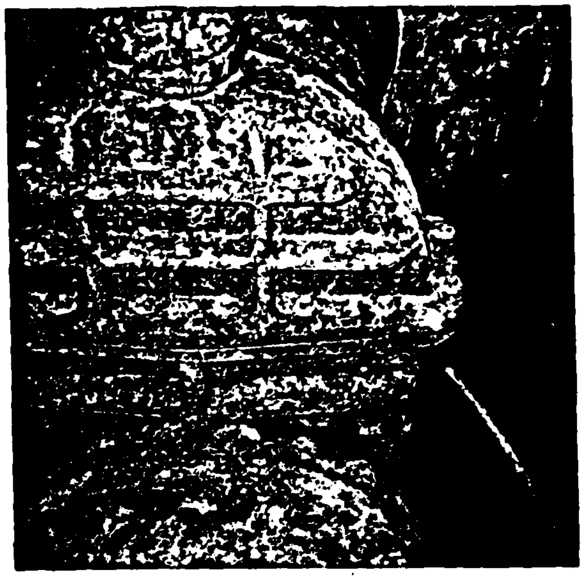
Phelps Brook Dam



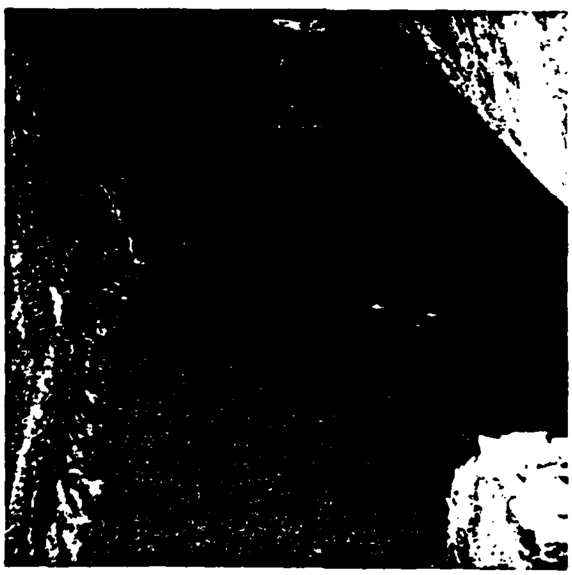
#1 View looking East



#2 Upper Gate House

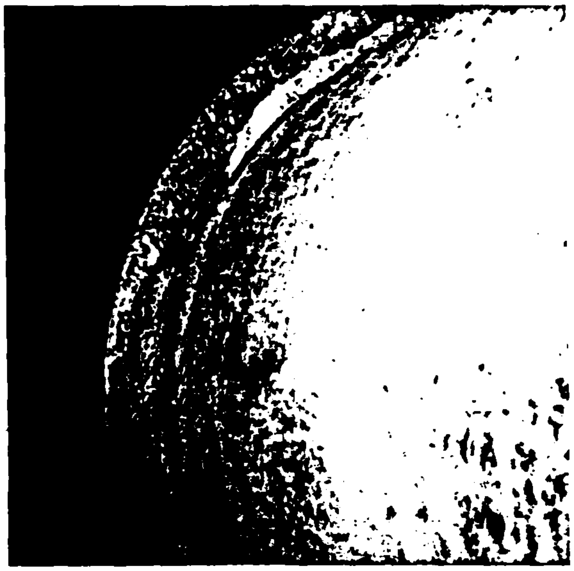


#3 Bolts on bonnet and flanges need replacing in Lower Gate House.

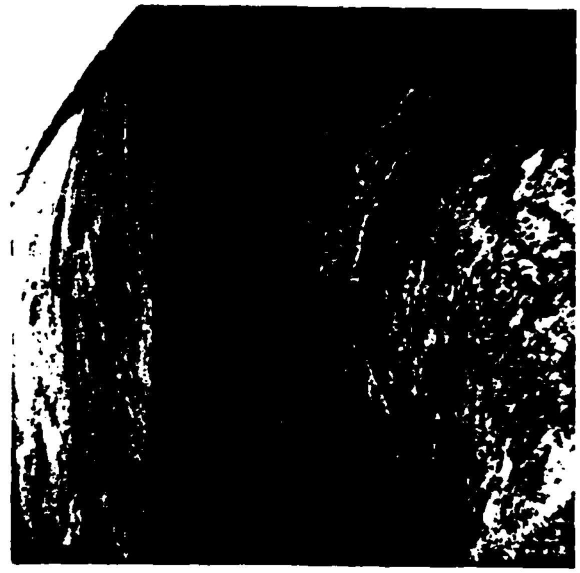


#4 Leak in Conduit between Gate Houses.

#5 Leaks and deposits and upper end of Conduit.



#6 Leak at joint in pipe in Conduit



#7 Sludge accumulation in Conduit

#8 Wood blocking needs replacing in Conduit

HARTFORD COUNTY, CONNECTICUT
WATER BUREAU
DESIGNING DIVISION

DATE 4 Feb. 1975

INSPECTION OF WATER BUREAU FACILITIES

SYSTEM Supply FACILITY Dam

NAME OF FACILITY Phelps Brook Dam

LOCATION Burlington, Conn.

INSPECTORS:

NAME	TITLE	DIVISION/DEPT.
P. J. Revill	Ch. Des. Engr.	Designing

CONDITION OF FACILITY:

Upper Gate House – Inlet well & exterior of bldg. Generally good. For further details see report of 7 Feb. 1975 in General report files

WORK SUGGESTED BY OPERATING AUTHORITY:

Revise layout of U.G.H. for easier stop log/screen placement.

RECOMMENDATIONS:

Repair exterior of substructure

SEE PHOTOS

Upper Gate House
Eroded substructure
Sound superstructure

WATER BUREAU
DESIGNING DIVISION

DATE 24 Dec. 1974

INSPECTION OF WATER BUREAU FACILITIES

SYSTEM Supply FACILITY Dam

NAME OF FACILITY Nepaug Dam

LOCATION New Hartford, Conn

INSPECTORS:

NAME	TITLE	DIVISION/DEPT.
R E Conepach	Sr. Engr.	Designing
P J Revill	Ch. Des. Engr	"

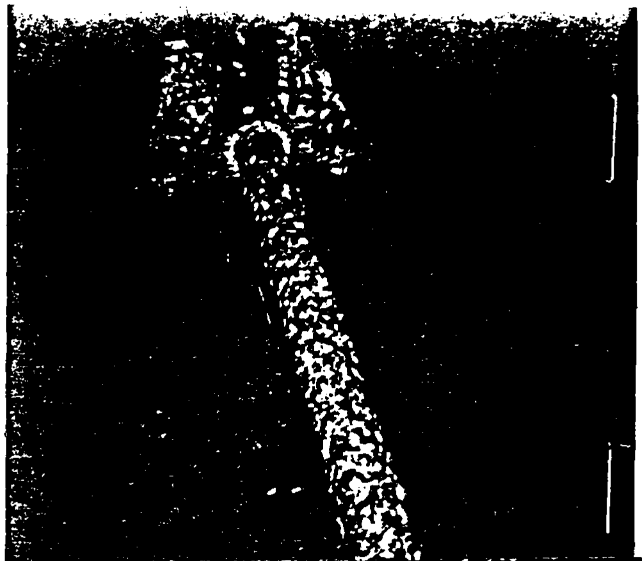
CONDITION OF FACILITY:

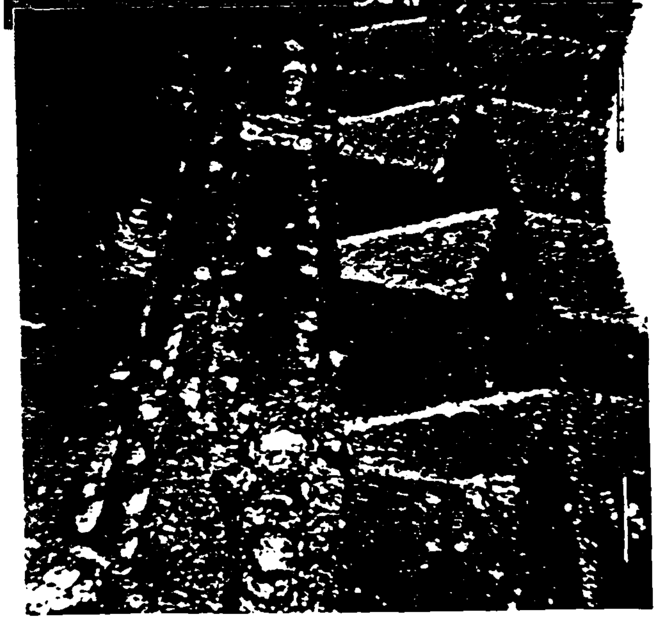
Upper Gate House .. Inlet Well - Condition generally good. For further details see report of 26 Dec. 1974 in general report files

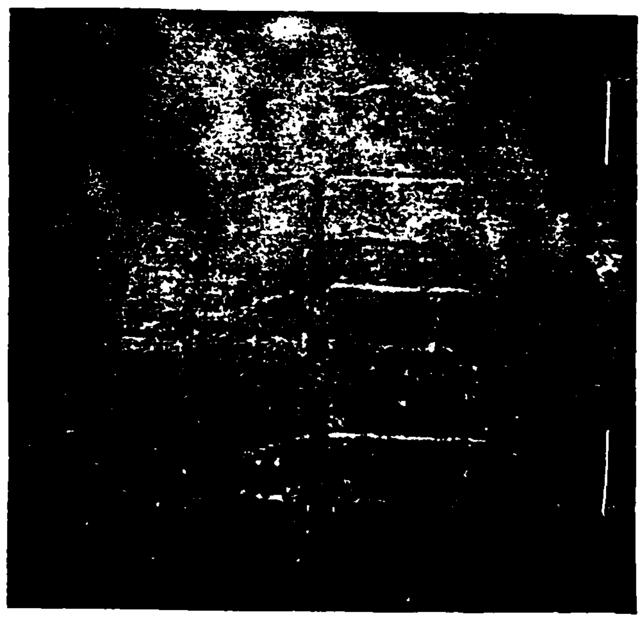
WORK SUGGESTED BY OPERATING AUTHORITY:

RECOMMENDATIONS:

Photos taken







RD COUNTY, CONNECTICUT
WATER BUREAU
SIGNING DIVISION

DATE 19 JULY 1977

INSPECTION OF WATER BUREAU FACILITIES

SYSTEM SUPPLY FACILITY DAM

NAME OF FACILITY NEPAUG DAM

LOCATION NEW HARTFORD, CONN

INSPECTORS:

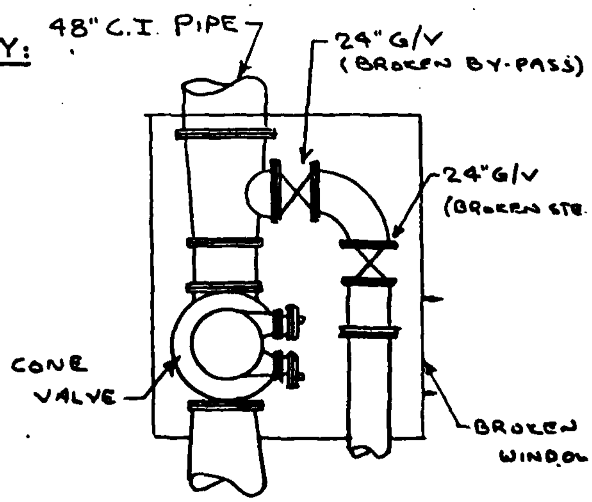
NAME	TITLE	DIVISION/DEPT.
NOEL GESSAY	DRAFTSMAN	DESIGNING
ED CRANDELL	FOREMAN	SOURCE OF SUPPL·

CONDITION OF FACILITY: LOWER GATE HOUSE:

NO FLOORING, WINDOW BUSTED OUT - 24" GATE VALVE CLOSEST TO 48" C.I. PIPE BY-PASS FROZEN UP BROKEN OFF (DUE TO NO WINDOW IN GATE HOUSE DURING WINTER) OPENING FOR BY-PASS SEALED. OTHER 24" GATE VALVE OPERATING STEM BROKEN, VALVE INOPERABLE

WORK SUGGESTED BY OPERATING AUTHORITY:

RECOMMENDATIONS:



: METROPOLITAN DISTRICT
O[illegible] COUNTY, CONNECTICUT
WATER BUREAU
DESIGNING DIVISION

REF. NO. S- 1402
DATE Jan 1978

INSPECTION OF WATER BUREAU FACILITIES

SYSTEM Supply FACILITY Dam

NAME OF FACILITY Nepaug Dams - Aluminum Water Screens

LOCATION

INSPECTORS:	NAME	TITLE	DIVISION/DEPT.
	P.J. Revill	C.D. Eng.	Designing

CONDITION OF FACILITY:

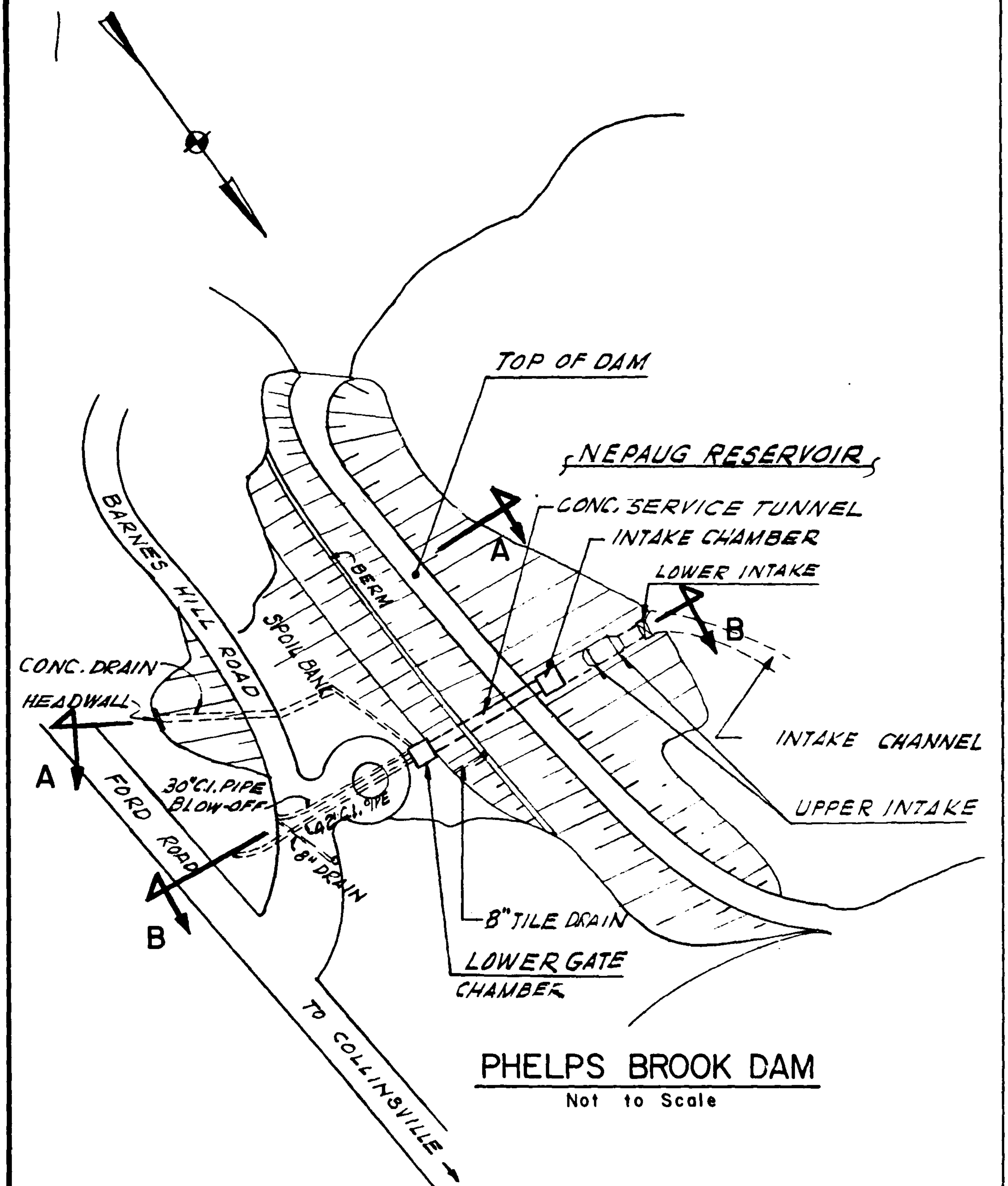
One screen, made in 1976 under Cont. MW 76-13, sent to P.J.R's office after screens show pitting of aluminum after a few month's service. Attempts to have aluminum companies inspect futile. After being in PJR office for 10 months, inspected as noted below & returned to Nepaug.

~~WORK SUGGESTED BY OPERATING AUTHORITY:~~

~~RECOMMENDATIONS:~~

Pitting of aluminum under "tuberculations" of white crystals & "stuff". Pits about 1/10" dia and 2/100"± deep. Most numerous where stainless steel screening laps over frame, but no area completely free. Up to 8± /sq. in. Pins & intermediate cross channels appear more severely corroded than rest of frame (generally)

Attachment Pictures. (None), B-42 (Number)

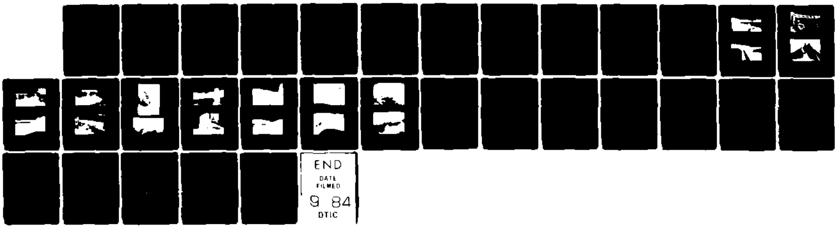


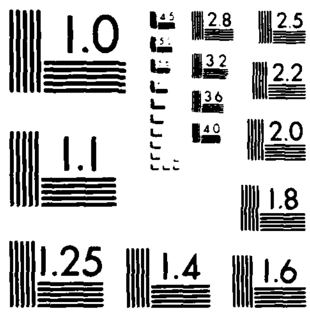
PHELPS BROOK DAM

Not to Scale

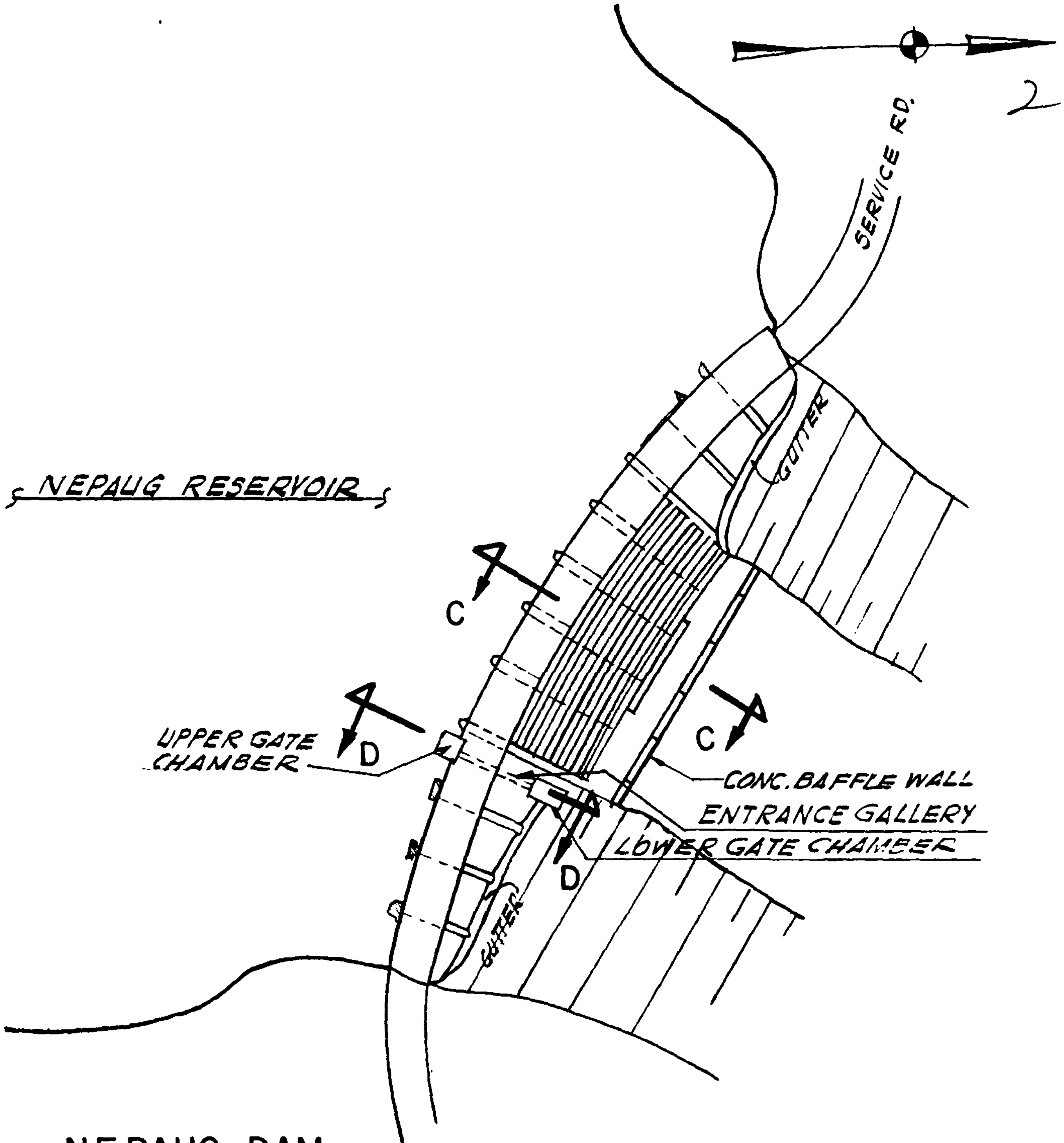
AD-A144 327 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
NEPAUG DAM (CT 00370)..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV SEP 78

UNCLASSIFIED F/G 13/13 NL





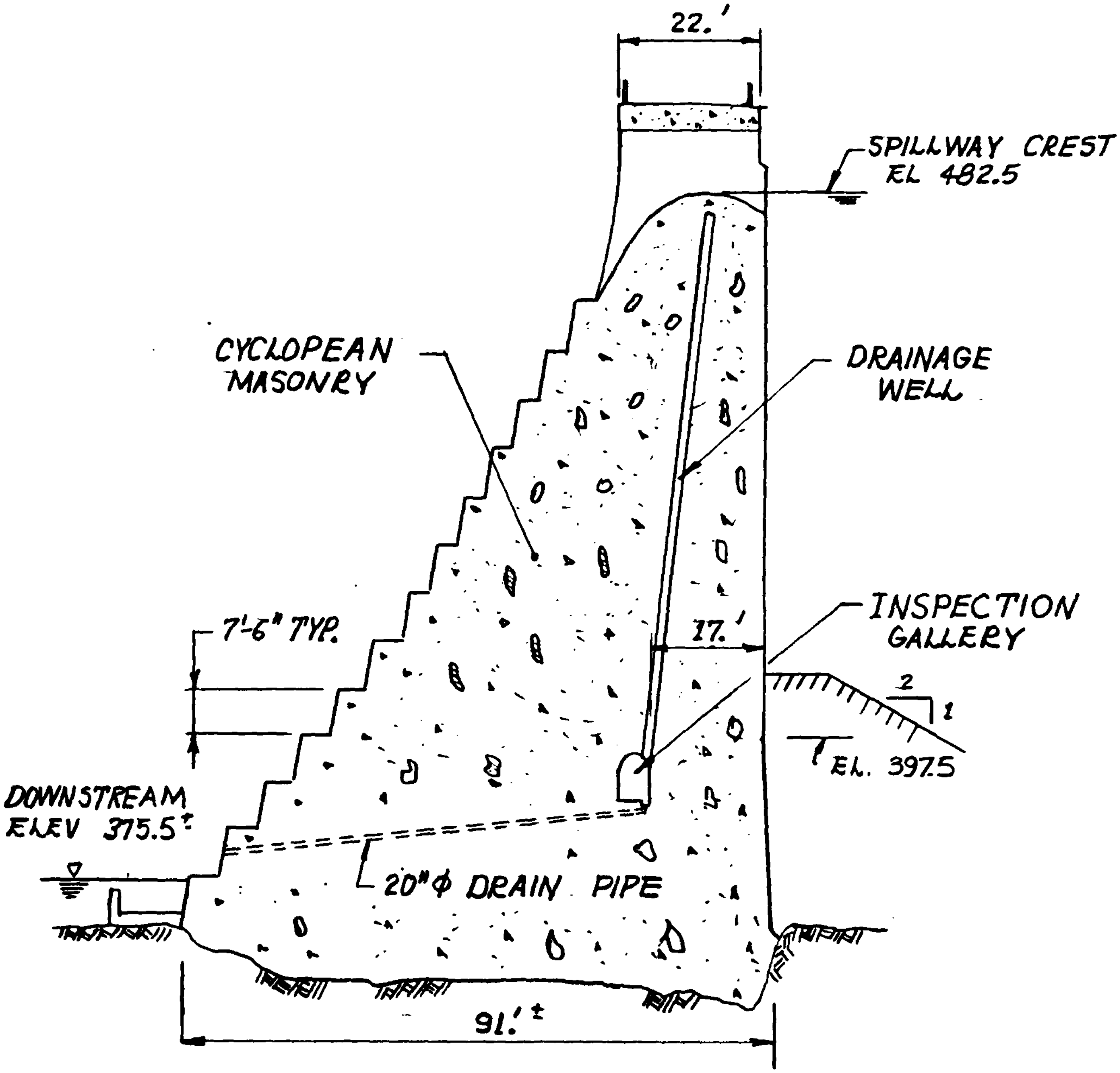
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A



NEPAUG DAM

Not to Scale

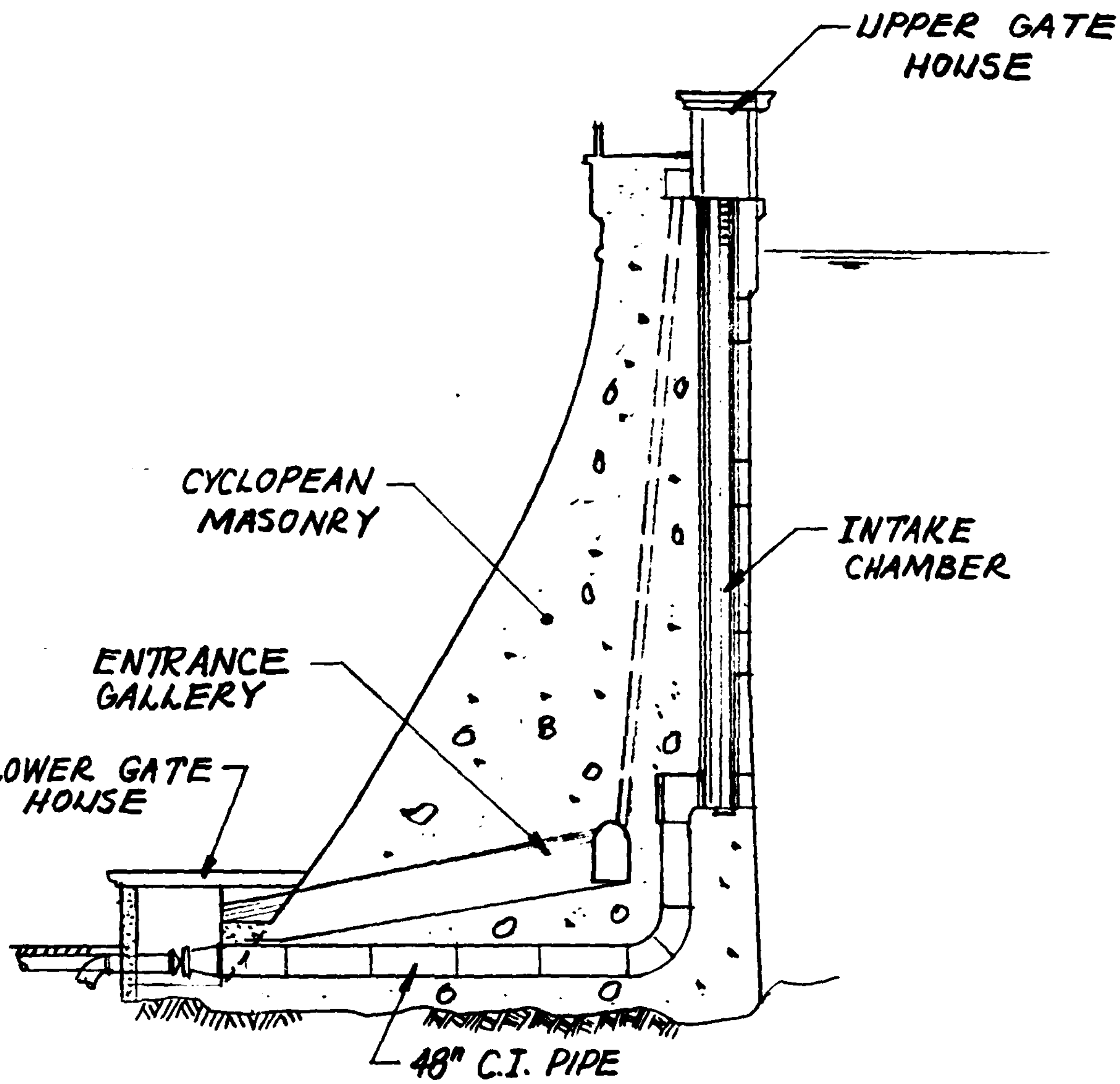
U.S. ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION WALTHAM, MASS.	NEPAUG RESERVOIR GENERAL PLAN	PLATE-1



SECTION C-C

NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION OF HARTFORD.

2



SECTION D-D

PLATE-2

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

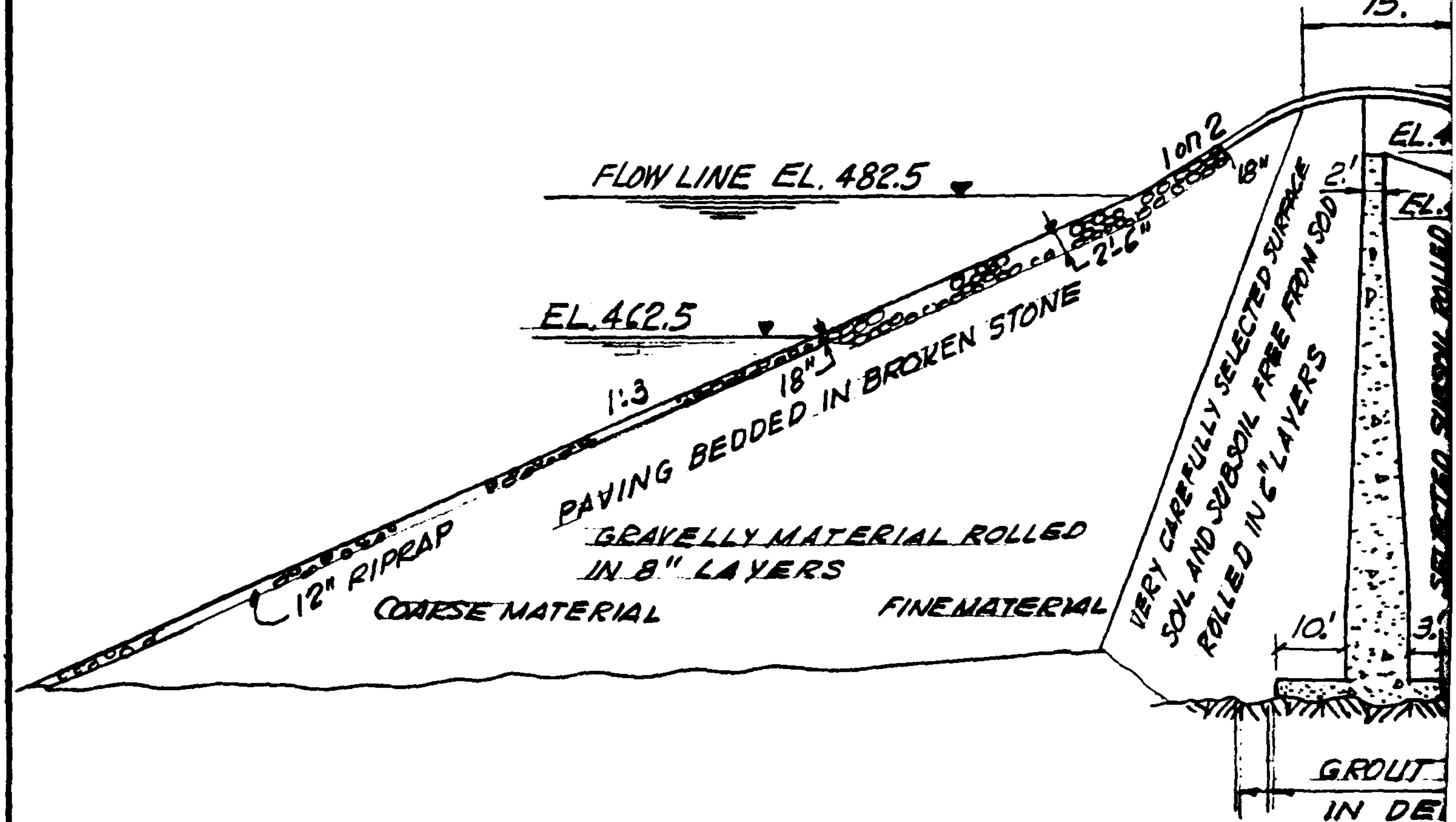
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

NEPAUG DAM

FARMINGTON RIVER — CONNECTICUT

SCALE: NOT TO SCALE

DATE: SEPTEMBER 1978



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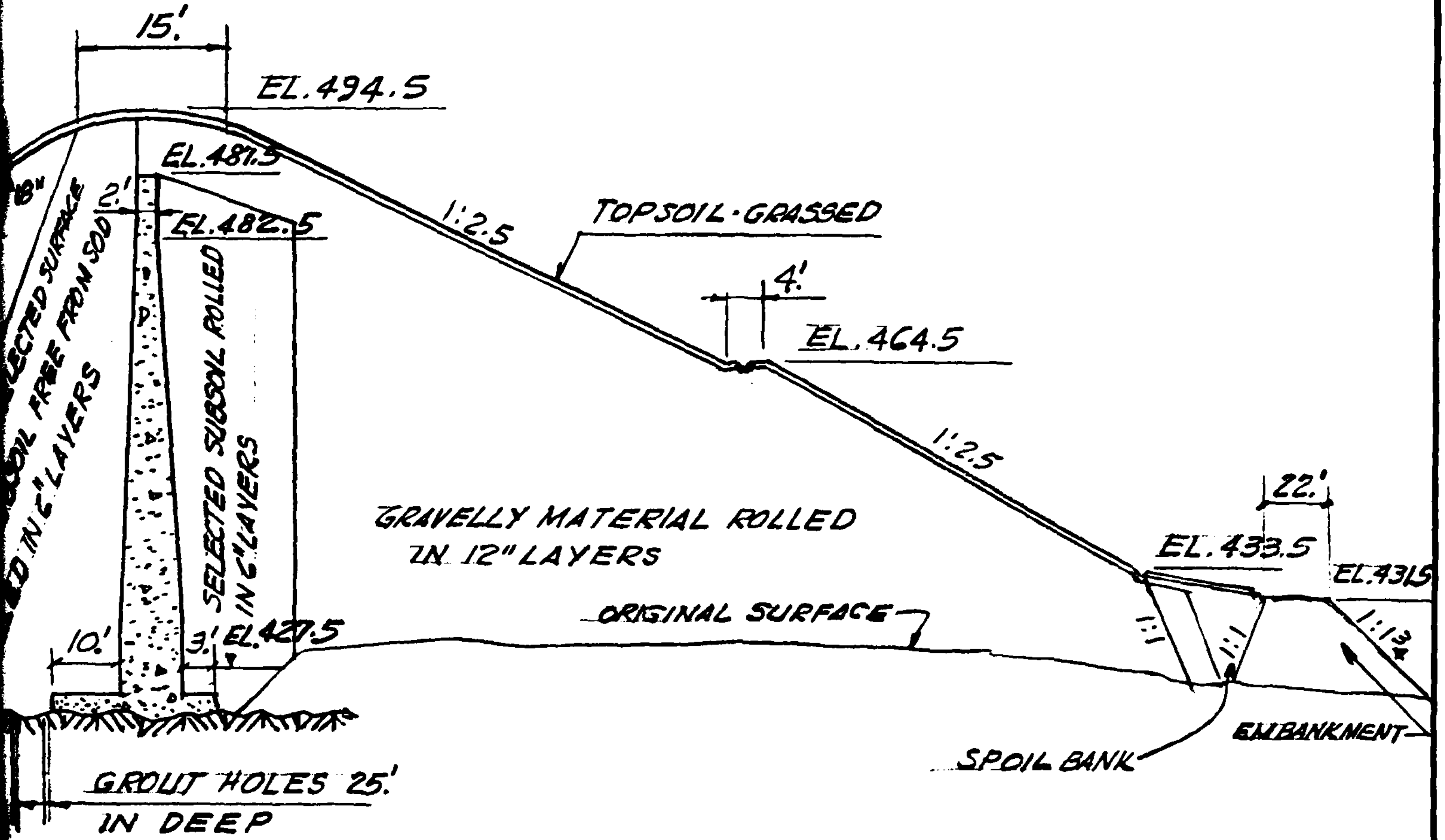
NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION OF HARTFORD.

2



SECTION A-A
Not to Scale

PLATE-3

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

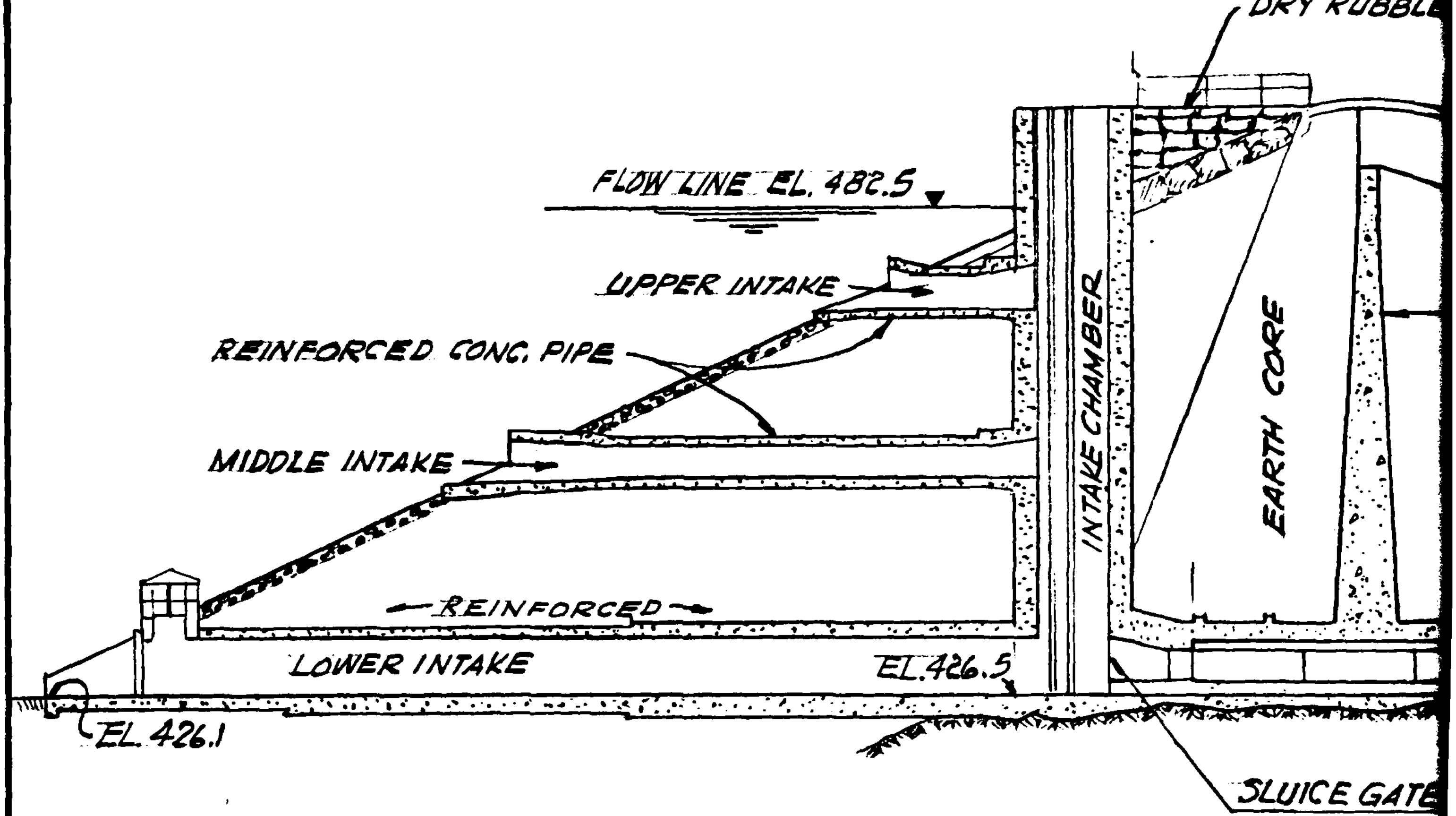
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PHELPS BROOK DAM

FARMINGTON RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE: SEPTEMBER-1978



SECTION

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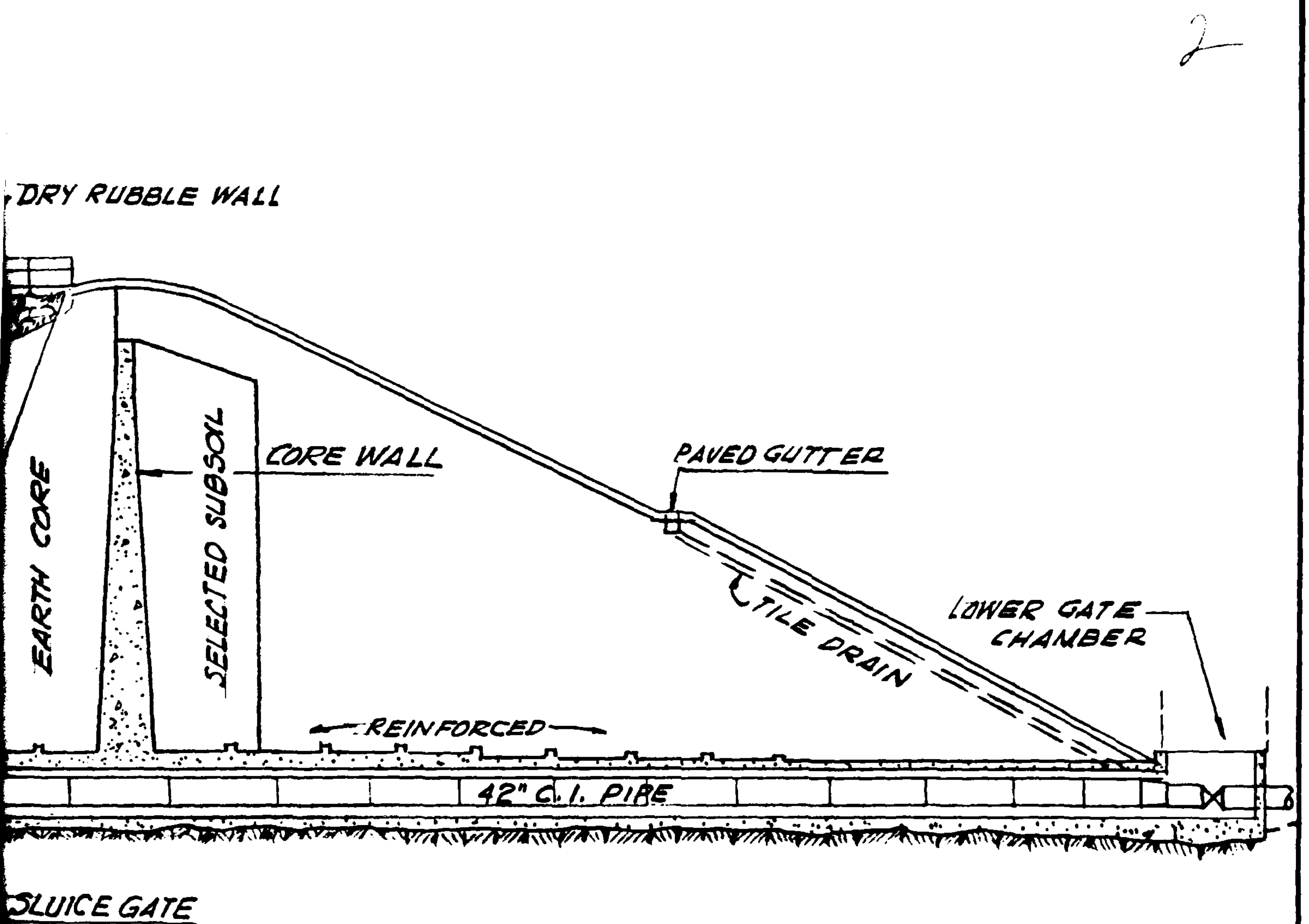
NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION OF HARTFORD.



CTION B-B

Not to Scale

PLATE-4

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PHELPS BROOK DAM

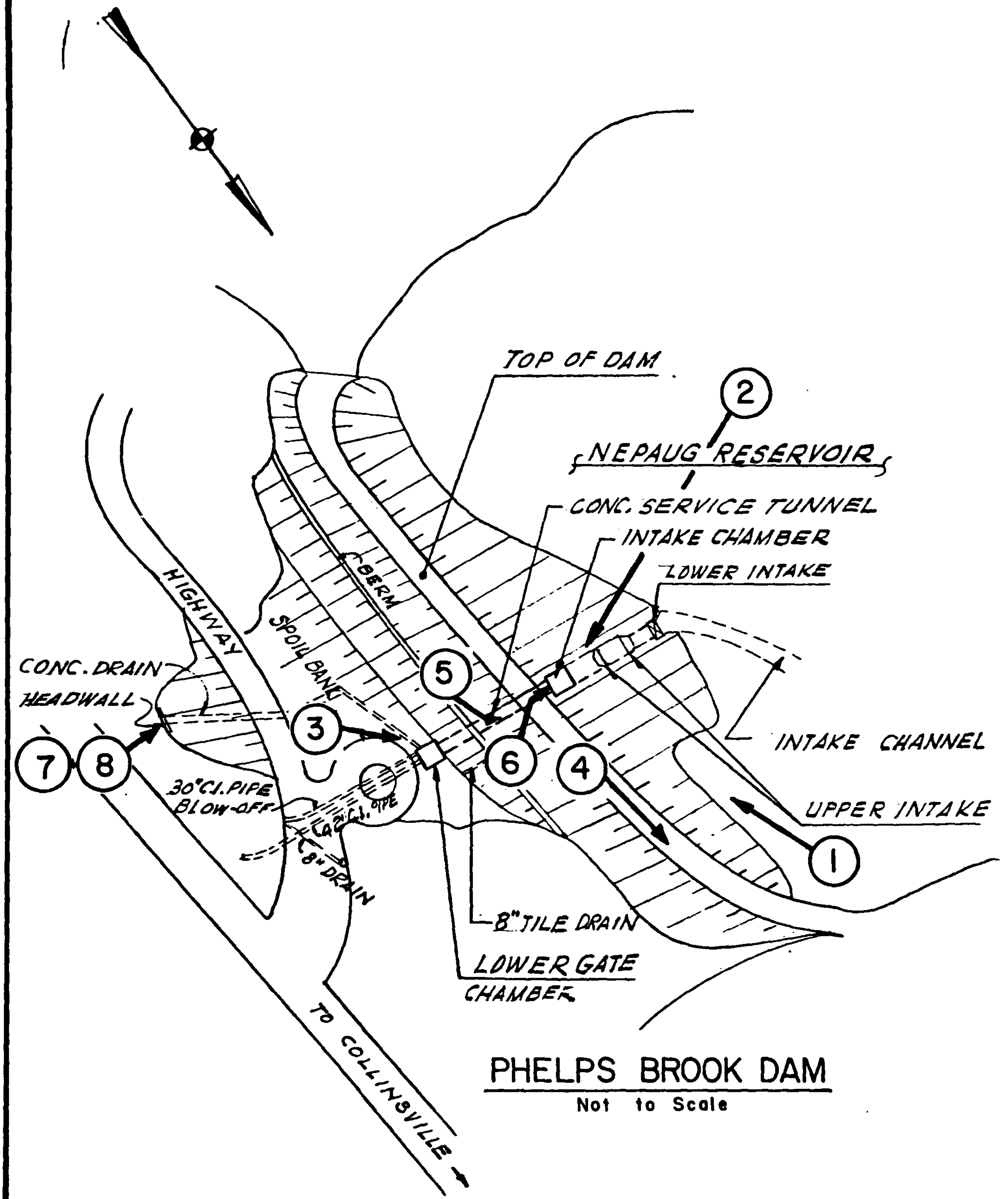
FARMINGTON RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE : SEPTEMBER-1978

APPENDIX C

PHOTO LOCATION PLAN	Plate 5
PHOTOGRAPHS	
NEPAUG DAM	II-1A to II-5A
PHELPS BROOK DAM	II-1B to II-4B



PHELPS BROOK DAM

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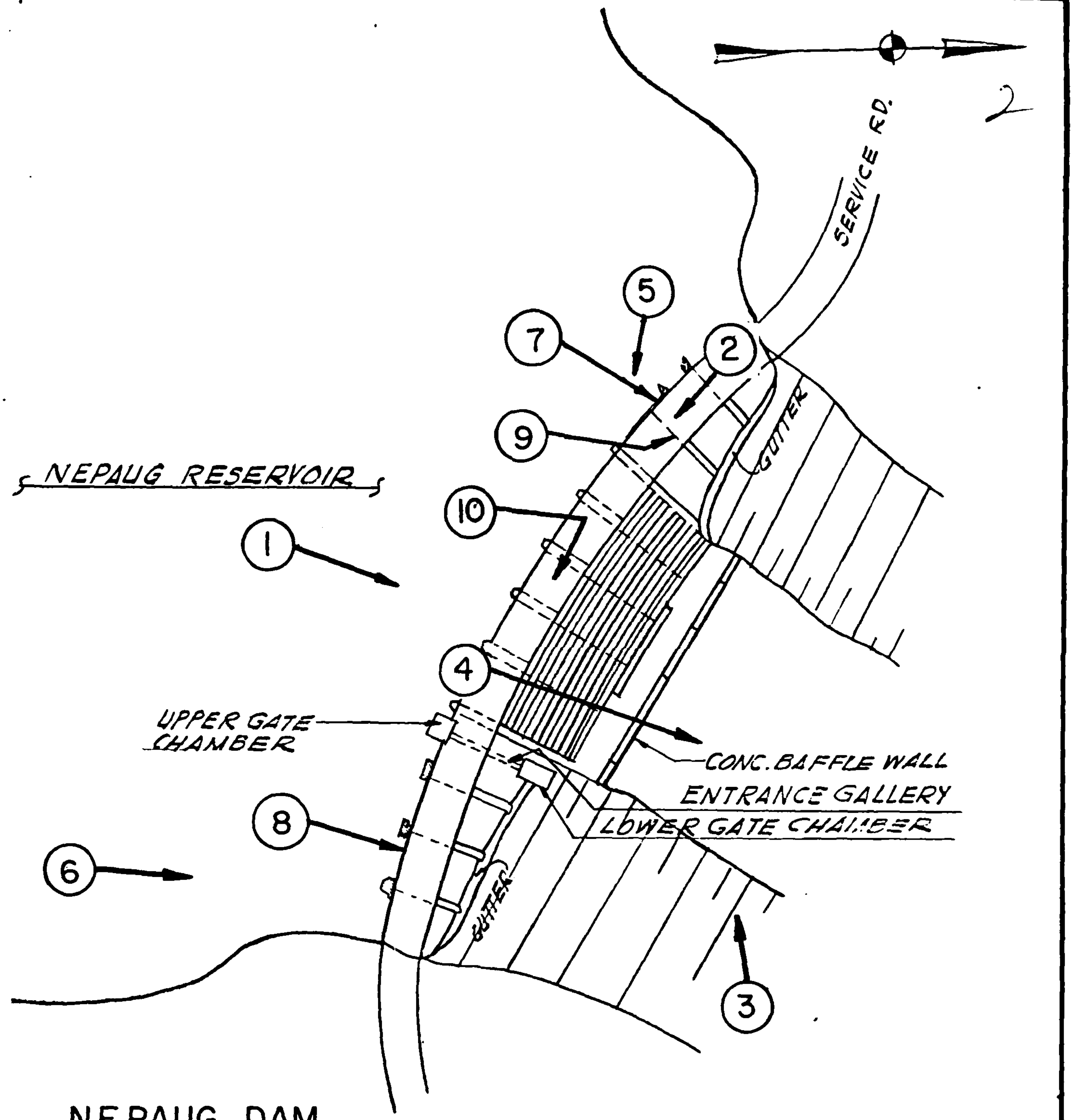


NEPAUG DAM

Not to Scale

U.S. ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION WALTHAM, MASS.	NEPAUG RESERVOIR PHOTO LOCATION PLAN	PLATE-5

PHOTO 1

UPSTREAM FACE OF DAM - GATE HOUSE AND SERVICE BRIDGE

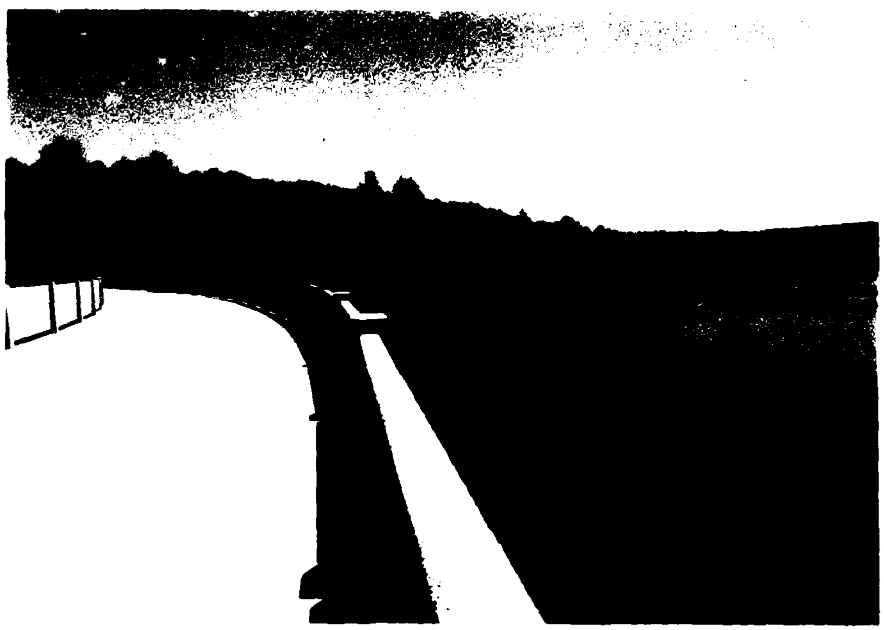


PHOTO 2

TOP OF DAM

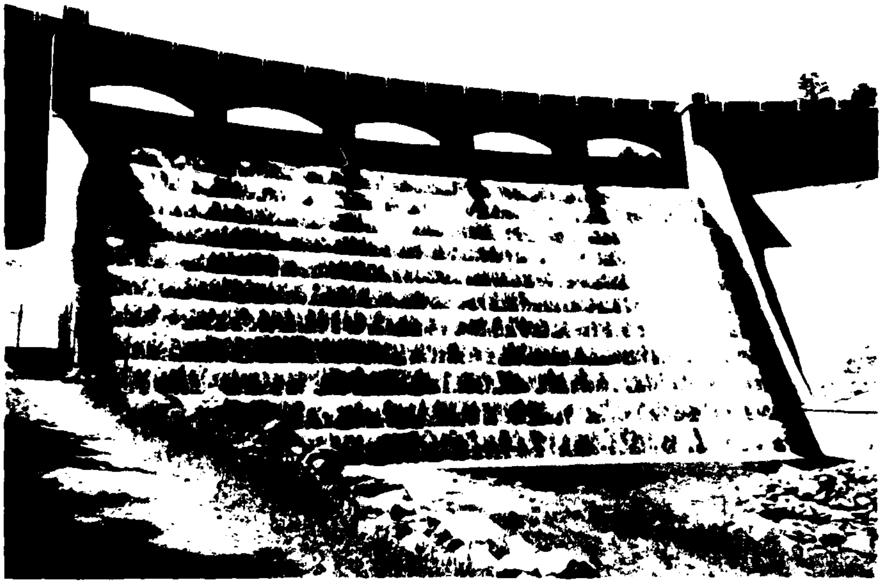


PHOTO 3

SPILLWAY

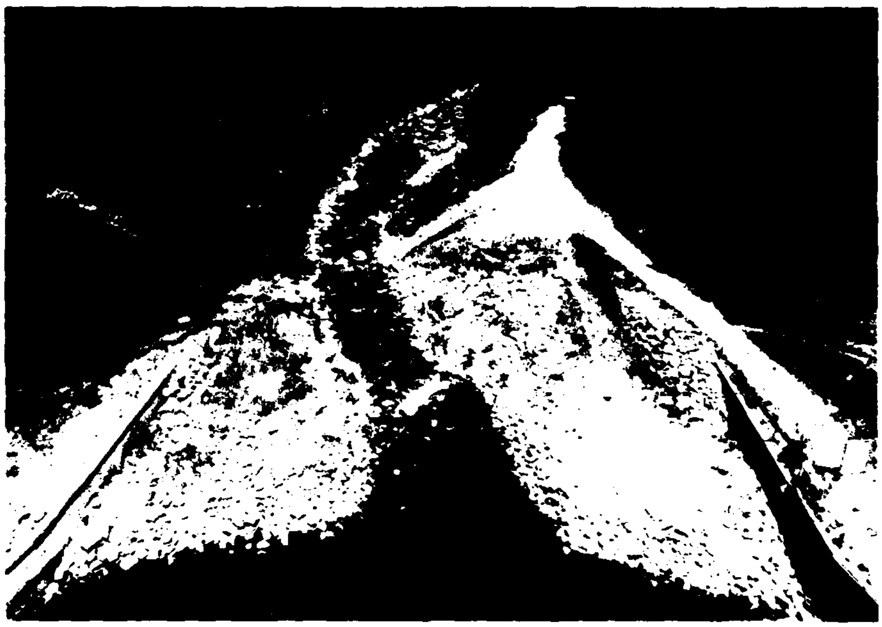


PHOTO 4

SPILLWAY CHANNEL

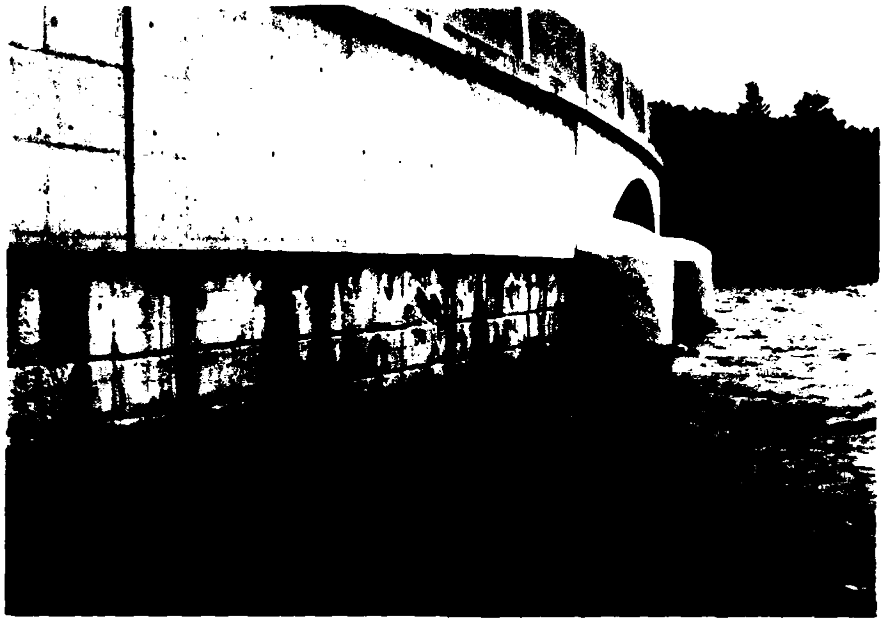


PHOTO 5

UPSTREAM FACE OF DAM - WEST SIDE

PHOTO 6

UPSTREAM FACE OF DAM - EAST SIDE

PHOTO 7

CONCRETE SPALLING - UPSTREAM FACE OF DAM

PHOTO 8

CONCRETE SPALLING - UPSTREAM FACE OF DAM

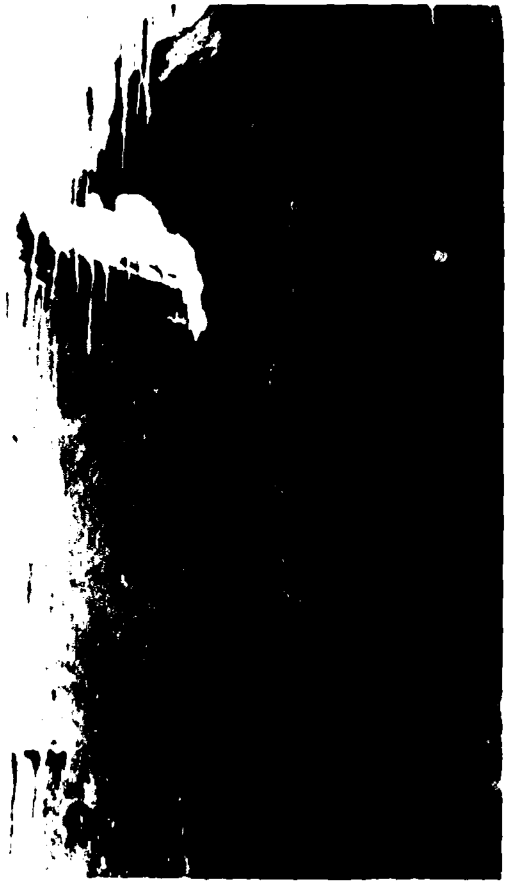


PHOTO 9
CONSTRUCTION JOINT - INSPECTION GALLERY

PHOTO 10
INSPECTION GALLERY - DRAIN HOLES

PHOTO 1

UPPER GATE HOUSE AND UPSTREAM FACE OF DAM

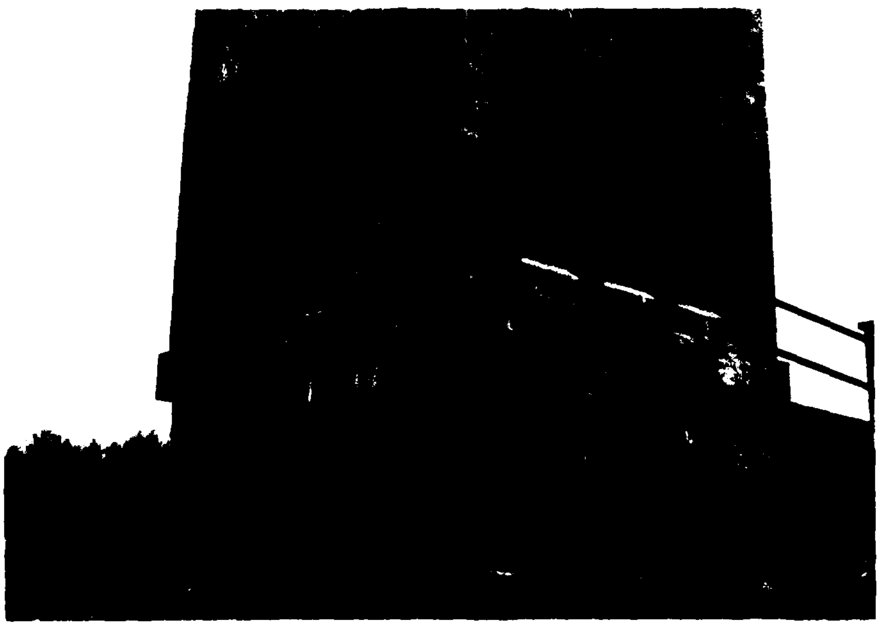


PHOTO 2

UPPER GATE HOUSE - CONCRETE SPALLING

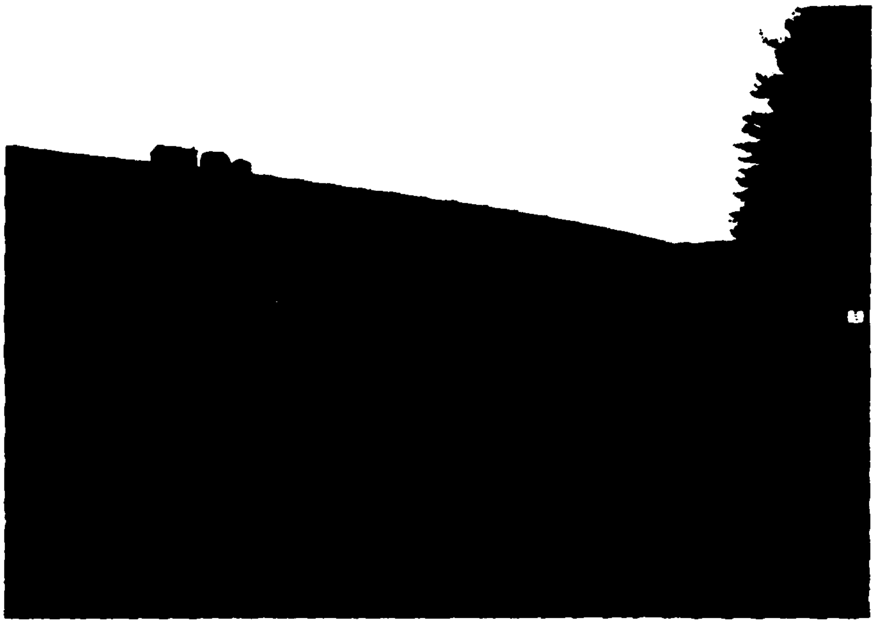


PHOTO 3
LOWER GATE HOUSE

PHOTO 4
TOP OF DAM

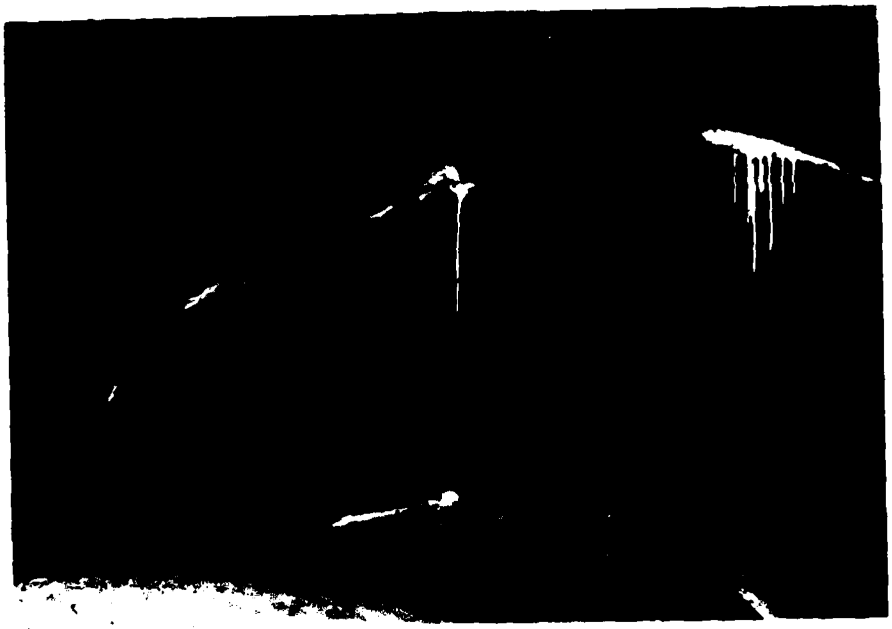


PHOTO 5

SERVICE TUNNEL - CONSTRUCTION JOINT

PHOTO 6

SERVICE TUNNEL - HEADWALL

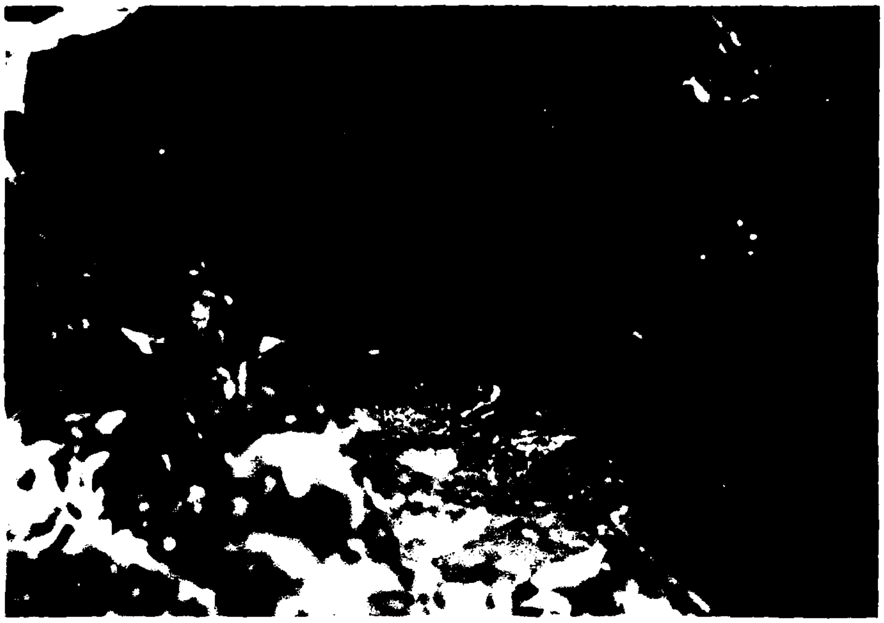


PHOTO 7

DRAINAGE OUTLET

PHOTO 8

FLOW MEASUREMENT

APPENDIX D

STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS

Nepaug

I Section @ Dam

① $S = 37{,}775$ Ac-ft

② $Q_{p1} = 8/27\,(W_b\sqrt{g})\,Y^{3/2} = 8/27\,(160)\sqrt{32.2}\;113^{3/2} = 323{,}140$ cfs

③ see stage discharge sheet

II Section @ Rte 179 crossing, Collinsville

④ A. $D_1 = 28'$ $\quad A_1 = 12800\ ft^2$ $\quad L_1 = 10{,}000$

$V_1 = 2938$ Ac-ft

B. $Q_{p2} = 323140(1 - 2938/37{,}775) = 299{,}760$ cfs

C. $D_2 = 27'$ $\quad A_2 = 11520$

D. $A_{avg} = 12160\ ft^2$, $\quad V_{avg} = 2790$ Ac ft

$Q_{p2} = 323140(1 - 2790/37775) = 299{,}273$ cfs

$D_2 = 27.2'$ $\quad A_2 = 11840\ ft^2$

III Section @ Rte 177 crossing Unionville

④ A. $D_2 = 27.2'$ $\quad A_2 = 11840\ ft^2$ $\quad L = 28{,}500'$

$V_2 = 7746\ ft^2$

B. $Q_{p3} = 299{,}273(1 - 7746/37775) = 237{,}905$ cfs

C. $D_3 = 24.3'$ $\quad A_3 = 9600\ ft^2$

D. $A_{avg} = 10720\ ft^2$ $\quad V_{avg} = 7013$ Ac ft

$Q_{p3} = 299{,}273(1 - 7013/37775) = 243{,}710$ cfs

$D_3 = 24.5$ $\quad A_3 = 9760\ ft^2$

IV Section @ NY, NH & H RR crossing, River Glen

④ A. $D_3 = 24.5$ $\quad A_3 = 9760\ ft^2$ $\quad L_3 = 5000'$

$V_2 = 1120$ Ac ft

B. $Q_{p4} = 243710(1 - 1120/37775) = 236{,}484$ cfs

C. $D_4 = 24.3$ $\quad A_4 = 9280$ Ac ft

D. $A_{avg} = 9520$ Ac ft $\quad V_{avg} = 1092$ Ac ft

$Q_{p4} = 243710(1 - 1092/37775) = 236{,}665$ cfs

$D_4 = 24.3$ $\quad A_4 = 9700\ ft^2$

STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAGHS

PHELPS BROOK

I Section @ Dam
① $S = 33180$ Ac ft
② $Q_{p1} = 8/27\, W_b \sqrt{g}\, y^{3/2} = 8/27(280)\sqrt{32.2}\ 67^{3/2} = 258{,}180$
③ see stage discharge sheet

II Section @ Rte 177 Crossing, Unionville
④ $AD_1 = 25'$ $A_1 = 10080\ ft^2$ $L_1 = 22500'$
$V_1 = 5206$ Ac-ft
B. $Q_{p2} = 258180(1 - 5206/33180) = 217{,}670$ cfs
C. $D_2 = 23.5'$ $A_2 = 8800\ ft^2$
D. $A_{avg} = 9440\ ft^2$ $V_{avg} = 4876$ Ac-ft
$Q_{p2} = 258180(1 - 4876/33180) = 220{,}240$ cfs
$D_2 = 23.8'$ $A_2 = 8880\ ft^2$

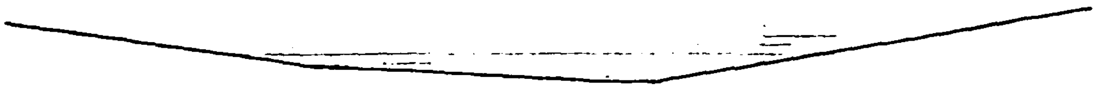
III Section @ NY,NH & H RR Crossing, River Glen
④ A. $D_2 = 23.8'$ $A_2 = 8880\ ft^2$ $L_2 = 5000'$
$V_2 = 1019$ Ac-ft
B. $Q_{p3} = 220240(1 - 1019/33180) = 213475$ cfs
C. $D_3 = 23.3'$ $A_3 = 8480\ ft^2$
D. $A_{avg} = 8680\ ft^2$ $V_{avg} = 996$ Ac-ft
$Q_{p3} = 220240(1 - 996/33180) = 213630$ cfs
$D_3 = 23.3'$

STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

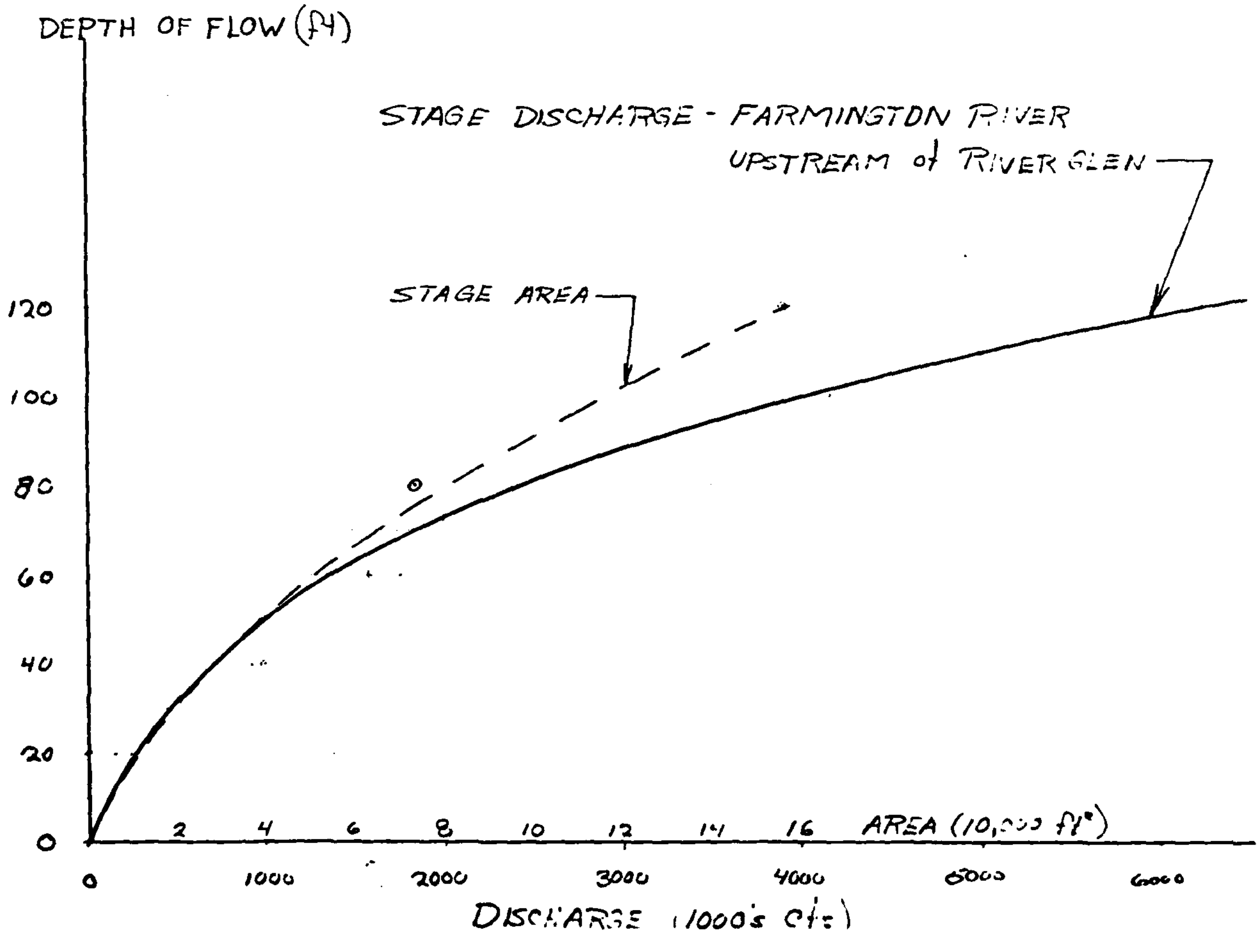
TYPICAL SECTION- FARMINGTON RIVER

$V = \frac{1.486}{n} R^{2/3} S^{1/2}$ $S = .0028$

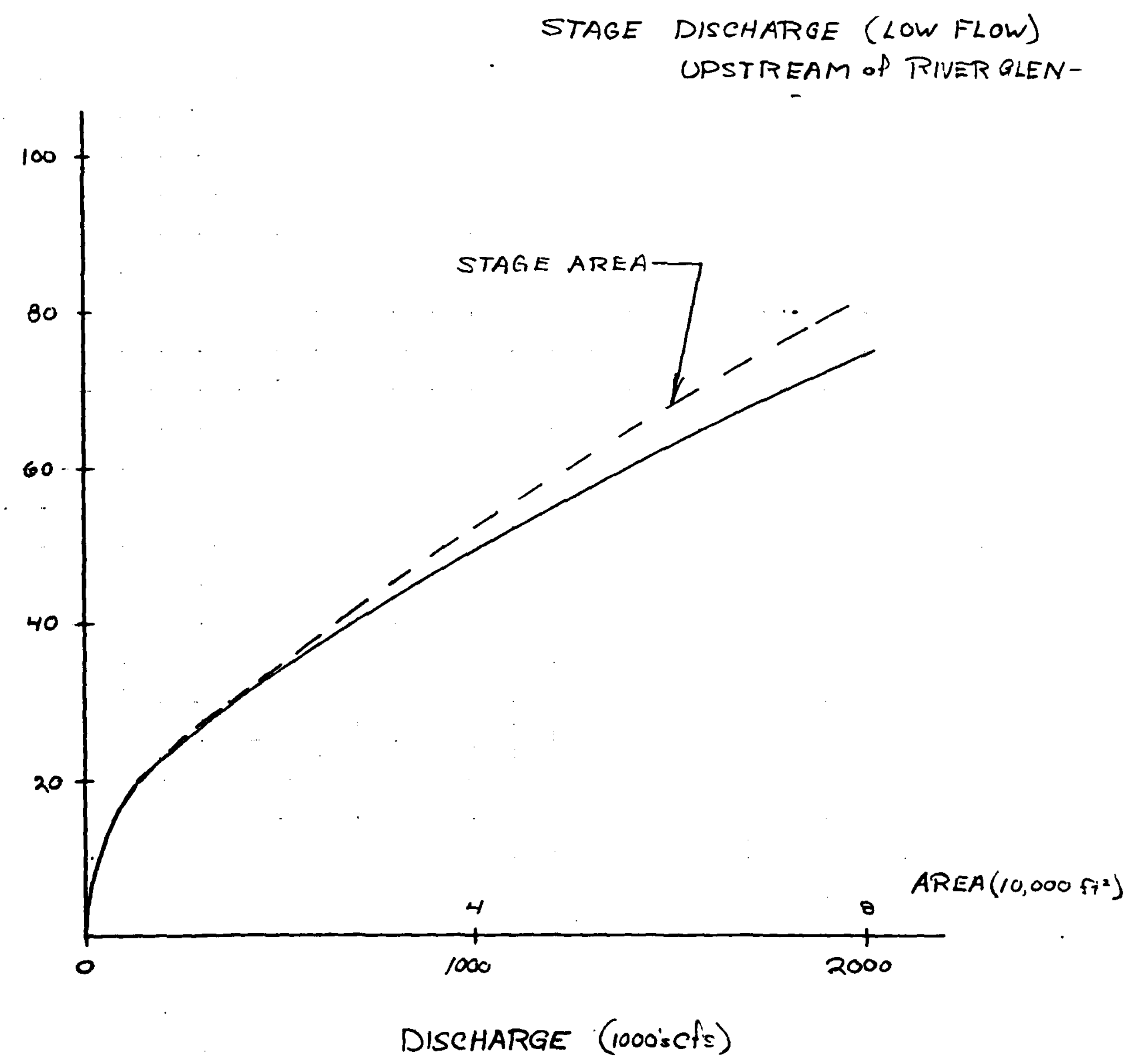
$n = .035$ (avg.)



D_{ft}	W_{ft}	A_{ft^2}	R	$R^{2/3}$	$S^{1/2}$	V_{fps}	Q_{cfs}
10	300	2000	6.67	3.54	.0527	7.92	15,840
20	590	9600	16.27	6.43	.0527	14.4	138,240
40	1230	40,000	32.52	10.2	.0527	22.8	912,000
60	1480	64000	43.24	12.33	.0527	27.62	1,767,680
80	1670	73600	44.08	12.49	.0527	27.95	2,057,[illegible]
100	1890	118,400	62.65	15.79	.0527	35.37	4,187,760
120	2100	156,800	71.67	17.75	.0527	39.76	6,234,3[illegible]



TYPICAL SECTION - FARMINGTON RIVER



LEGEND

DENOTES LIMITS OF FLOODING IN CASE OF DAM FAILURE

PLATE-6

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

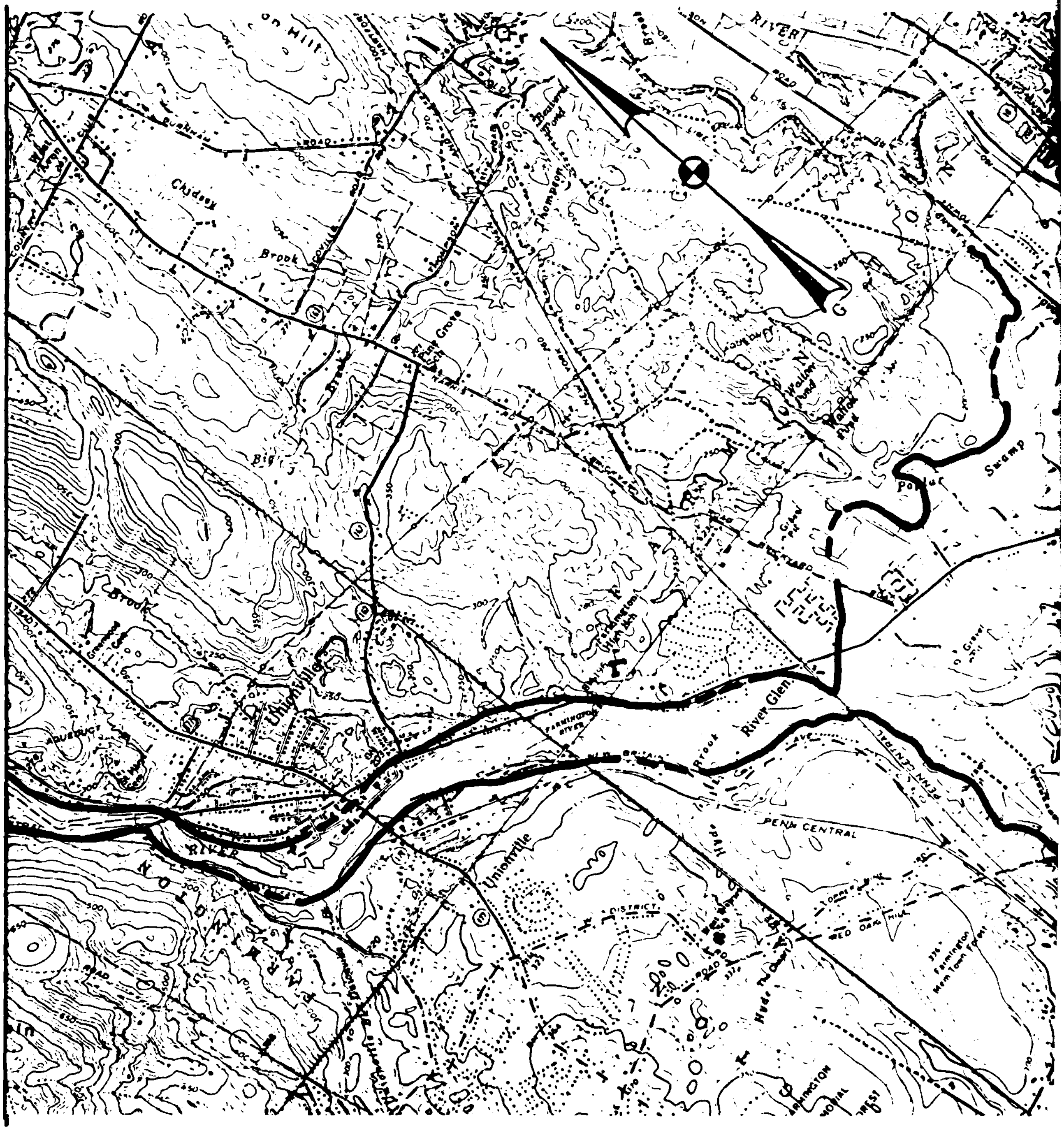
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

NEPAUG DAM

FARMINGTON RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE: SEPTEMBER 1978



SCALE 1:24000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

DENOTES LIMITS OF FLOODING IN CASE OF DAM FAILURE

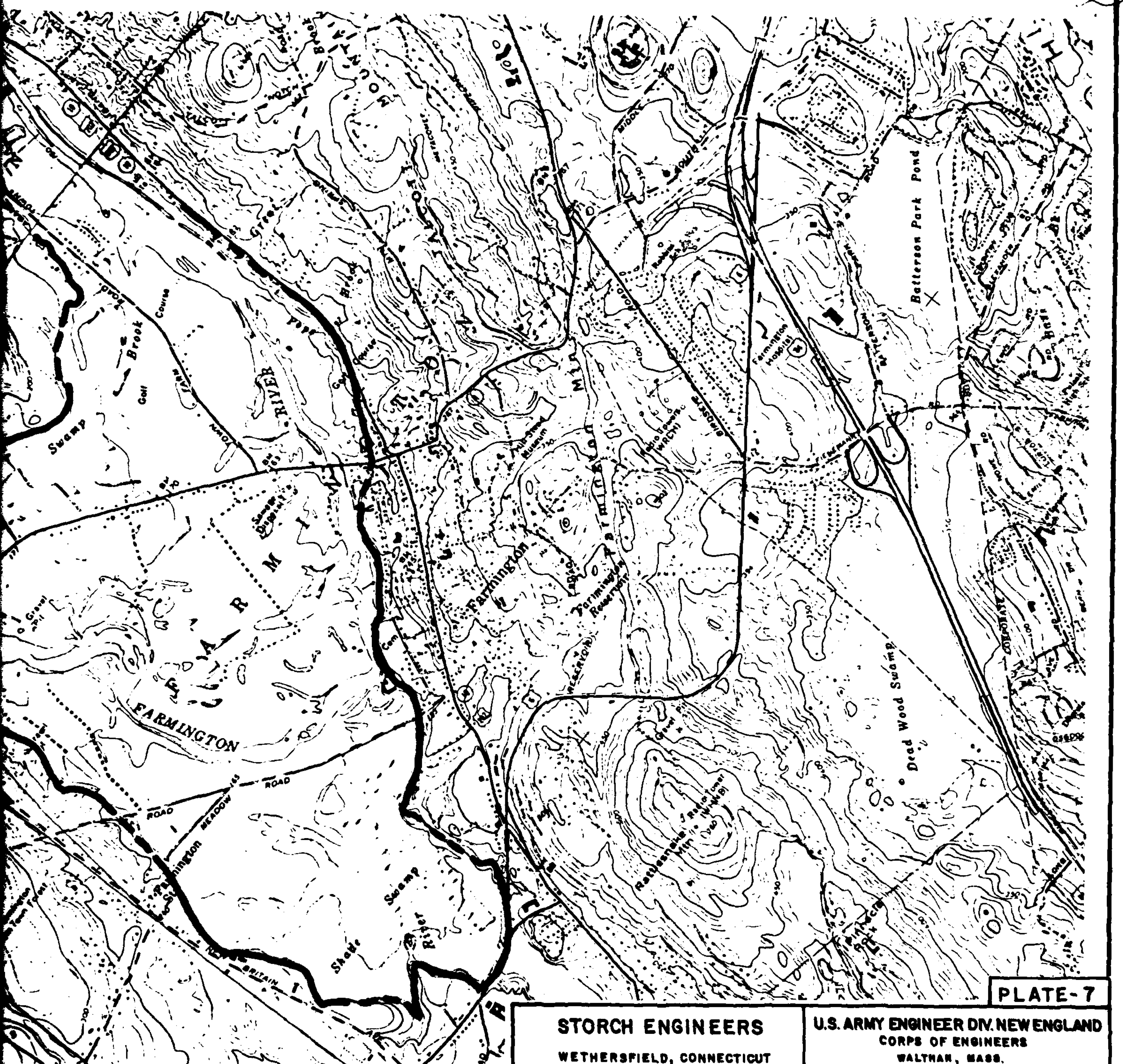


PLATE-7

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

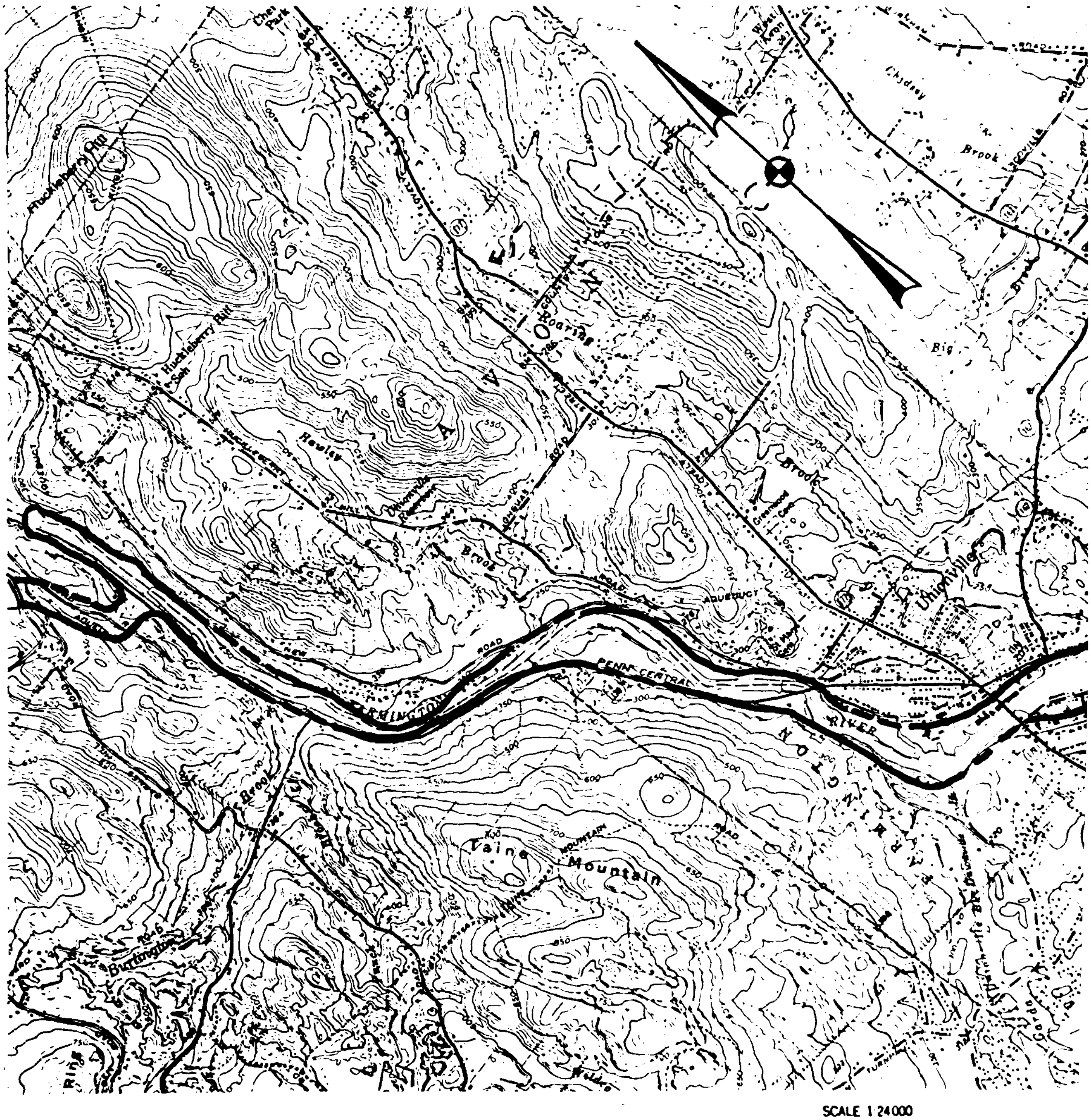
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

NEPAUG DAM

FARMINGTON RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE : SEPTEMBER 1978



LEGEND

DENOTES LIMITS OF FLOODING IN CASE OF DAM FAILURE

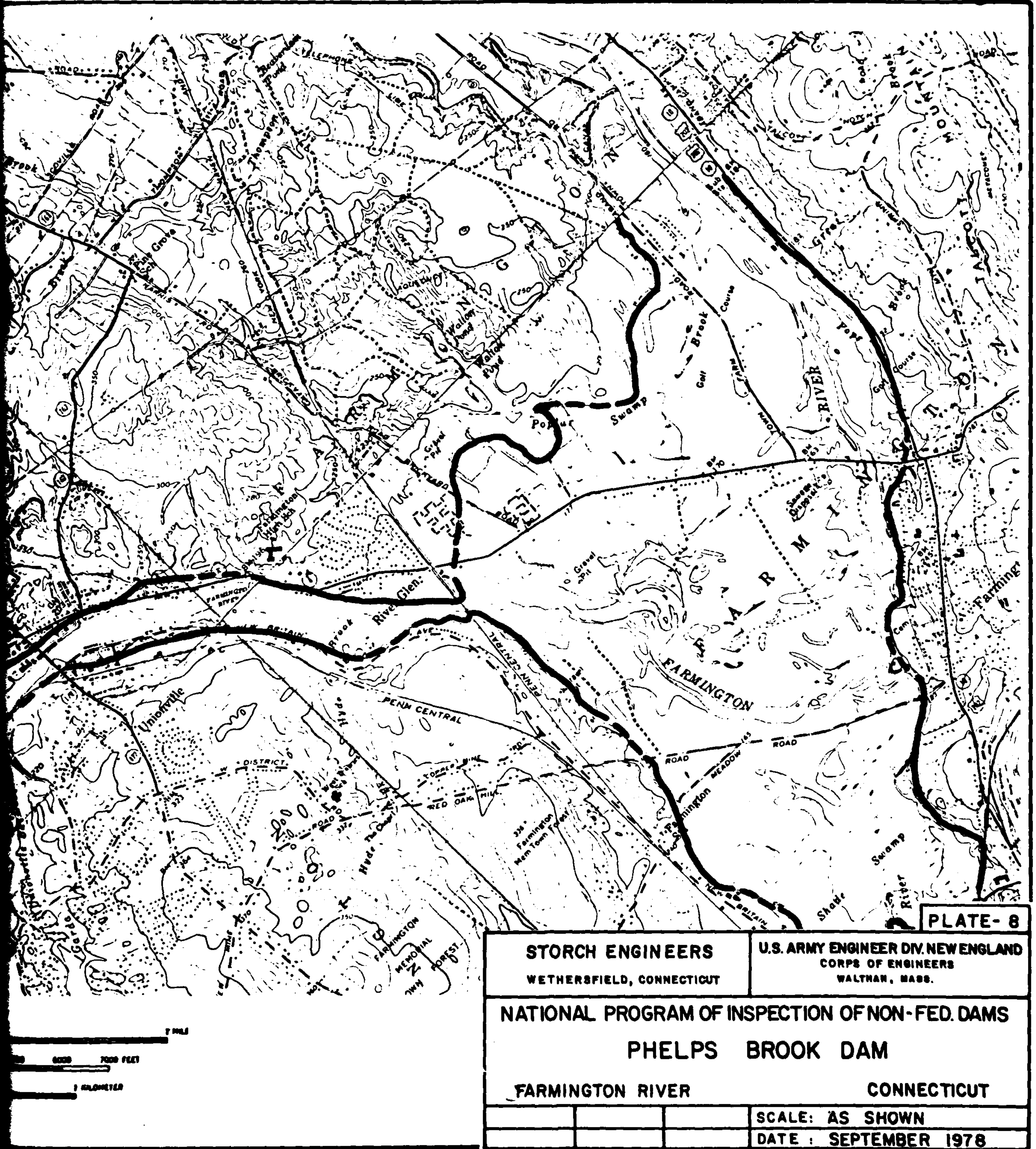


PLATE- 8

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PHELPS BROOK DAM

FARMINGTON RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE : SEPTEMBER 1978

APPENDIX E

INVENTORY FORMS

11-58

END

DATE
FILMED

9-84

DTIC